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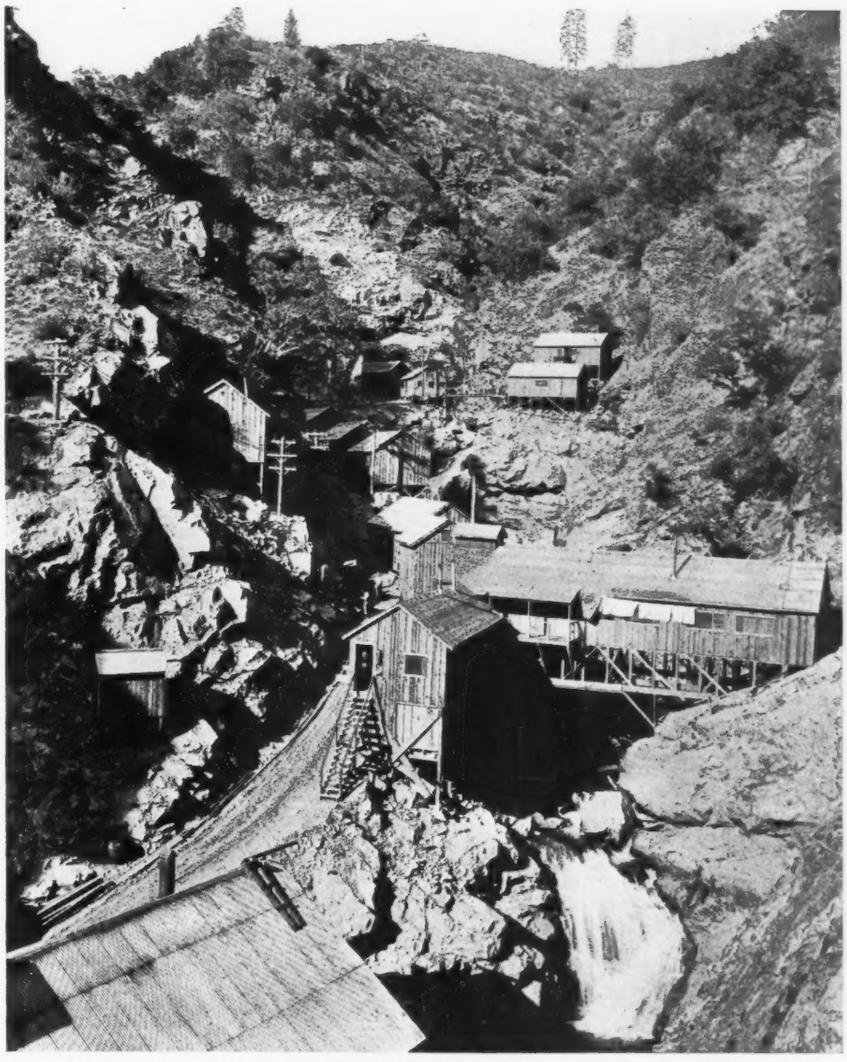
The Marketing of Barytes

By S. W. Thompson



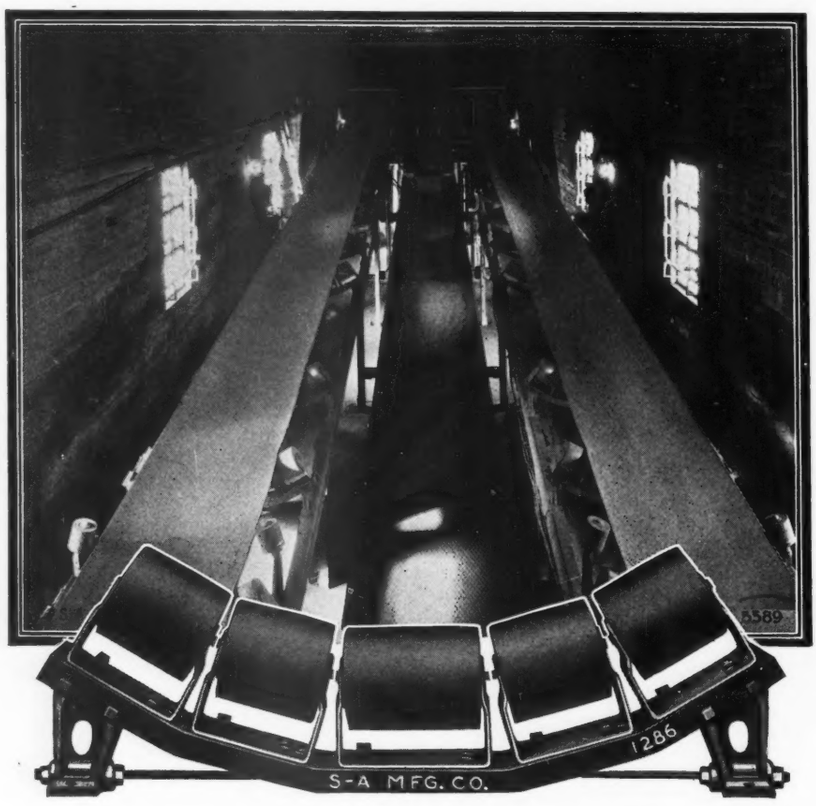
One of five camps in the Sierra Nevada in California where the 18-mile tunnel of the Hetch Hetchy Aqueduct project is being driven.

Driving an Eighteen-Mile Tunnel Through the Sierra Nevada

By Arthur B. Parsons

A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

July 15, 1922



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The Moribund Mining Law Revision

THOSE who are opposed to any changes in the existing mining laws will be glad to know that there is no chance of any legislation going through. Congressmen who at first thought the revision of the mining law an opportunity to win political credit for themselves recoiled with sudden frigidity from it when the vociferous minority voiced its unfounded apprehensions. True it is that this is a "government by noise." Some hearings have been held, in which expert engineers and geologists testified as to the advisability of changing existing regulations as to future claims; but in view of the attitude of Congress it may safely be said that the movement is spent.

Secretary Fall took a part in the ceremonies by sending a letter to the Committee on Mines and Mining stating that in his opinion "it would be inadvisable at this time to pass a law radically changing the general laws now in effect." This shows an astonishing lack of co-ordination between Secretary Fall and the Bureaus of which he is the ultimate chief, for the bill against which he advises was proposed by a committee of the Bureau of Mines, the principal work of drawing it up was done by one of the attorneys of the Bureau, and the bill has had the Bureau's support. Yet Secretary Fall believes, according to our Washington correspondent, that it would be unwise to create confusion in the vested rights represented by the thousands of mining claims which have been located under the existing laws. If Secretary Fall had taken a few minutes off to read the bill, or to telephone to one of his Bureau chiefs, he could have ascertained that the bill does not affect the extralateral rights of claims already located, and that it is not and could not possibly be retroactive, as has been repeatedly pointed out. But, unfortunately, the position of the Secretary of the Interior carries a commanding influence, however shallow may be the investigation behind the opinion. It is a discouraging undertaking for engineers to try to collaborate with politicians to secure logical changes. The methods of cerebration of the two classes are quite distinct.

The Elbow Lake Boom

THE report has come to us that the Elbow Lake gold discovery in northern Manitoba has failed to yield sufficient returns on sampling to warrant hope of profitable mining, and that the "Hollinger Syndicate" which held the chief and orginal "find" will desist in its exploration. This news comes as a disappointment though it need not dim the ardor of the prospector and the moneyed mining adventurer in their game enthusiasm for the investigation of the great unknown north country. It is a land of mystery and of primitive pleasures for the hardy, on the border land of the unmapped wilderness of lakes, muskegs, rivers, and stunted forests which reach up to the Arctic. Elbow Lake lies in the path of a canoe route, used only by occasional prospectors, and was until recently reached only by a water trip by canoe and portage of several hundred miles. Then a prospector discovered coarse gold here and there in the ancient schists, found plucky mining men to undertake the exploration, and the excitement was on. Although snow lay over the muskeg, timbered ridge, lake, and river when the boom came, that was no deterrent to the staking of claims by the joyous young men who came in chasing the dog teams, or stealing a ride on the sleds for the last few miles of the long journey. Other companies, including the Tonopah Mining Co., of Nevada, its appetite sharpened by the profitable financial outcome of the Mandy discovery, sent in its representatives and staked claims near those held by the "Hollinger crowd." Indeed all the snow for a goodly distance around was staked. The Dominion law which obtains in Manitoba does not exact a "discovery" and these snow-staked claims found a fairly ready market in Toronto and in New York, at a flat quotation of so much per claim. Incidentally, old finds of doubtful value in the neighboring country, the holders of which had been unable to interest capital, were enveloped in the glory of Elbow Lake and were taken over and explored in the dead of a northern winter. Explorers remembered Porcupine, and were minded to be the early birds that get the first bite at the golden apples of Hesperides, if our readers will bear the fruity metaphor.

The latest news is that in spite of the free gold splashed here and there, the bulk of the rock contained nothing, so that the average was very low. If this has been ascertained for the ground of the Hollinger Syndicate—as has been reported to us—it will likely be the general experience. It is the history of other gold discoveries in this region, notably Herb Lake and Beaver Lake, which have lured by their coarse gold specimens, but failed in their tonnage and average assays. The golden apples contain a hidden worm and the early bird has caught the worm.

Let not our readers assume that we decide, on the basis of this reported setback in Elbow Lake and our reminder of past experiences in the region, that the country is unpromising. Never shall it be said of us "and the expert turned it down." For, seriously, in a region where the Mandy was a real mine, small but rich, and Flin Flon, great and low-grade, a near-mine at the worst; and where such abundant blotches of gold are found in many places, it is indeed a very likely place to search for treasure. Let the prospector fit out again with good courage, and let the sporting capitalist back him loyally, for it is in such ways as this that the hidden wealth of the North shall eventually be won. We applaud the men that have given of their time and money to the search, and if our readers think to detect any inharmonious note in our recital, it is only out of regret that we were not among those who took the chance and lost. The game was worth the candle.

The Hetch Hetchy Project

IN THIS ISSUE we publish a description of the Hetch Hetchy water-supply system, in California, by A. B. Parsons. This engineering project offers many points of interest, and the article itself is all the more welcome because a visit to Hetch Hetchy is one of the principal items on the program for the fall meeting of the Institute at San Francisco. The credit for the inception of the project and for the organizing of the enterprise is due mainly to M. M. O'Shaughnessy, engineer to the City of San Francisco. In accomplishing his good work the City Engineer had to depend not only upon his professional knowledge of the means for utilizing the resources of Nature but also upon his knowledge of men, for municipal politics is an art hardly less compelling than engineering. To have been born in the south of Ireland was as essential to success as to have received a good training in technology. The work at Hetch Hetchy has involved sundry phases of mining, more particularly the driving of several tunnels in rocks of different texture and hardness, and the use of various types of machines with which most of our readers are familiar. Mr. Parsons gives details, some of which, particularly those relating to the drilling, will be of immediate practical value. The care of machine-drills and the selection of drill-steel are among the matters he discusses. He criticizes the failure to use tamping, and makes a good case, we think, for his contention. The ventilation of the workings is another matter to which he gives proper space. The use of two kinds of machine-shovelers is described, with notes concerning the cost of repairs, which are heavy. In order to facilitate the financing of the project, the contractors were allowed a bonus; they give the sub-contractors a bonus, and these in turn give the men at the headings a chance to make a little extra by being speedy. The result has been the achievement of a record in rapid tunnel-driving. Mr. Parsons gives the figures, and many other interesting data.

The Southern and Central Pacific Railroads

THE RECENT DECISION of the U. S. Supreme Court requiring the Southern Pacific Railroad Company to surrender the ownership and control of the Central Pacific railroad is looked upon by many Westerners with dismay. The Central Pacific has been operated by the Southern Pacific as an integral part of its system for fifty years. The name Central Pacific, applied to the stretch of track from Ogden to Sacramento, has almost been forgotten. In 1885 the Central Pacific was leased to the Southern Pacific for ninety-nine years. The decision of the Supreme Court abrogates the lease on the principle that the merging of the two properties is in contravention to the anti-trust law of July 2, 1890. The suit now concluded was begun by the Government during the "trust-busting" period and followed the Union Pacific-Southern Pacific merger suit.

The mining, farming, and commercial interests of California, Nevada, and Oregon are affected by the decision. The Central Pacific has been the trunk line for east- and west-bound traffic between the Wasatch and over the Sierras to tide water. To establish it now as a separate unit will serve no economic or practical end. Terminals, tracks, shops, franchise rights, and equipment are so interwoven in ownership that the unscrambling cannot be effected without great injury to the public service. Undoubtedly the cost of transportation will be increased by the creation of two railroad companies where one existed before.

We are informed that the San Francisco Chamber of Commerce has appointed a committee of fifty men, leaders in their respective lines, to consider the resulting situation and to seek means to enable the two railroads to be lawfully operated as one road. We hope that their efforts will be successful and that the uneconomic plan will not be carried out. We believe in the principle of competition, but competition which throws an additional drain upon the public purse is not worth the price.

The Journal-Press Journeyings

AT THE MOMENT of writing this note Mr. Robie is in Canada on a tour of the Canadian and Lake Superior mining regions, Mr. Young is on a tour in the Northwest, which will take in Washington, Oregon, British Columbia and Alaska; Mr. Rickard is at Nelson, B. C., attending the International Mining Convention, and plans to return by way of Idaho and Spokane, and Mr. Spurr is in Washington, D. C., getting in touch with developments of mining interest at the capitol. Mr. Wormser has just returned from his trip through Montana, Idaho and South Dakota.

And Now the Copper Radiator

THE PROFESSIONAL JUGGLER may be considered a man of considerable concentrative ability. His performance is a matter of practice, but it requires patience and precise action; in short, a question of thinking rightly at the right time, which, after all, is the fundamental of most pursuits. The ideal atmosphere for thinking rightly is that which allows absolute freedom from disturbances that tend to counteract concentration. However, the juggler has the advantages that there are no disturbing influences, he knows to a certainty what to expect, and is secure in that each move is anticipatory.

Automobile driving, from its very inception, has required clear thinking and precise action. Seldom is there provided the "ideal atmosphere," or at least for any prolonged period. The driver can, like the juggler, anticipate what may happen, but nine times out of ten his guess is different from that of his fellow driver on the road, and, not infrequently, disaster results.

However, it is not our purpose to enter into an extended discussion of the stupidity of the other driver, points of automobile etiquette, or even juggling. It more especially concerns the correcting of a particular evil that may be considered as one of the contributing causes of discomfort in automobile driving. By the elimination of certain mechanical handicaps we can gradually approach an "ideal atmosphere"; at any rate, one in which less attention need be paid to car performance and more to road contingencies.

We have given no little space in these columns to the merits of copper, and have called attention to as many different uses for that metal as have come under our observation. This we intend to continue; not to the exclusion, by any means, of the other metals, for each has its utilization depending on durability, adaptability, and price.

Among the annoyances—mechanical handicaps—which

confront the automobilist may be included an overheated engine and leaky radiator; but now, we are informed, this may be eliminated by the use of seamless copper tubes. It is claimed that there is no overheating with such a radiator, because of the great amount of direct cooling surface per square foot of front. The tubes lie horizontally, the cooling air rushes through them, and the water circulates around them. No rusting, leaking, clogging, or damage by freezing is possible, and in case of accident it is necessary to replace only the damaged tubes.

This innovation suggests other possible uses for the red metal. We recall an experience in a northern climate when we carefully, as we thought, drained the house radiators, only to find upon returning from a Christmas holiday that a small amount of water, which had remained in the base after all, had frozen solid, thereby cracking the cast iron so that it was necessary completely to replace several units. Copper, at that time was selling at 27c. a pound, but even at that price, with differential allowances for fabrication, if copper radiators had been installed there would have resulted a substantial saving over the expense involved in the refurbishing of the water-soaked areas, caused by the cracking of the radiators.

Selling One's Services

AN ENGINEER has one thing to sell—his services. The well-known psychological law of selling holds that to accomplish any sale the vendor must (1) secure the attention of the prospective purchaser, (2) arouse his interest, (3) convince him of the desirability of the thing on the market, and (4) gain a decision. Viewed in this light, the application for work in the office of a friend of ours, a well-known consulting engineer, by a young mechanical draftsman impresses us as being not only ingenious but effective. To us the method of approach, as the salesman would style it, is unique; it affords food for thought to other young engineers who are out of work.

The application consisted of a printed circular giving a chronological record of the life of the applicant, including details of his education and of his professional career, and reproducing six letters from former employers testifying as to the work he had done for them; and a printed letter, signed by the draftsman and addressed in typewriting, in which was set forth the reasons for submitting a printed application instead of seeking work by a personal call or by means of a letter written in longhand—a procedure that is approved, we believe, because it gives the employer an opportunity to study the applicant's character as revealed in his penmanship. As to this it may be argued that the average employer knows so little about handwriting that he is likely to be sadly misled if he endeavors to judge a man by a single letter. However this may be, this particular draftsman has excellent reasons for the course he pursued. The first is a matter of stern necessity. Having been among the many whose services were "discontinued" in 1921, and having no outside source of income, he found that before very long he was compelled to accept employment of a kind which did not make use of his special talent as a structural draftsman, but that did serve to provide a living. Naturally he desired to find a suitable situation, but while engaged at other work he did not have time to answer advertisements in person, or otherwise to seek new employment by indiscriminate personal interviews. Before he had taken the temporary job, he had found that most employers resented the infringement on their time caused by calls from applicants for work. Their time was wasted as well as his own. Moreover, it was impossible to see more than a very few men each day, and the chance of soliciting from the right man at the right time was remote.

This reasoning led to the conclusion that he must have recourse to correspondence, and again considerations of efficiency, of conservation of his own time and that of the employer, dictated the use of a printed rather than a "penned" letter. He desired to let the man to whom he applied know all about himself; and this required a long letter. He could write only a few such in a day, whereas his plan was to communicate with several hundred at a time, with the expectation that one would soon be found who needed a man with his qualifications. He also believed that in these progressive times it is an imposition to ask any busy man to struggle over the deciphering of a pen-written letter. Moreover, for accomplishing steps (3) and (4) in his program of salesmanship, he depended upon an interview in which the employer would have the candidate himself instead of his handwriting to "size up." The object of the letter was to discover where openings existed, and of course to arouse sufficient interest on the part of the "customer" to induce him to give the applicant the opportunity to present his case. The letter is composed in a straightforward style that leaves an impression of sincerity.

We should not think of advising every unemployed and unestablished draftsman, or assayer, or surveyor, or engineer to follow the example of this particular man; but we wish to emphasize the fact that the marketing of his services is one of the first problems of any engineer, and that to do this effectively he must use initiative and energy. We are inclined to think that if we had received the letter of the draftsman in question, and had had work of the character that he described, we would have been persuaded that he deserved a chance.

The Passing of the Princess Estate

THE LIQUIDATION of the Princess Estate & Gold Mining Co. marks the final chapter in the history of one of the earliest of the Western Transvaal enterprises. Incorporated in 1888, the company was operating thirty stamps in 1892. A cyanide plant was erected in 1894 and a new mill in 1895. The Roodepoort Central Deep property was acquired in 1911. Production to date has totaled £4,800,000, of which only £184,000 has been returned to the stockholders in the form of dividends. The resumption of mining operations on a profitable scale being considered impossible, the company has decided to follow the example of the majority of the other mines in the Roodeport district and take steps to go into voluntary liquidation.

The suspension of mining and milling operations is always tinged with regret; but although the stockholders of the Princess Estate have received but little in return for their confidence and cash, the district has benefited by the employment given to a large staff of salaried employees and wage earners over many years. *De mortuis nil nisi bonum.*

Mining in New Mexico

By T. A. Rickard

In days gone-by the Territory of New Mexico was made known as a mining region by the rich silver mines of Lake Valley, Pinos Altos, Cook's Peak, and Silver City; today the fame of the State of New Mexico rests chiefly upon the coal mines of Gallup and the copper deposits of Santa Rita. The Chino Copper Company's operations, on the site of the old Santa Rita Mining Company's workings, constitute by far the most important mining enterprise in New Mexico. So far the Chino, under the able management of John M. Sully, has yielded 21,000,000 tons of ore averaging 1.8 per cent copper; and from the proceeds it has paid $30,000,000 in dividends. The ore in reserve is estimated at 125,000,000 tons. Like the other big copper mines, the Chino was shut-down in April, 1921, and remained idle for a year; it is only now getting into its stride, the production being 4,000, as against a former maximum of 12,000 tons per day. The company employs 260 men at the mine and 300 at the mill. The supply of labor is abundant. Most of the metal-mining industry of New Mexico is in this part of the State, and within the limits of Grant County. From Santa Rita one can see Burro Mountain, near the Arizona boundary, where at Tyrone, the Phelps Dodge Corporation has spent a good deal of money in building a model town, including a railroad station and a department store of impressive character. The deposit of complex copper ore that is the basis for these improvements is not being mined, but the pump is kept going and 25 men are on the pay-roll, under the direction of the manager, E. M. Sawyer.

In the Organ mountains, near Las Cruces, the Phelps Dodge company did some work two years ago in copper prospects in limestone, but the option was relinquished. Efforts are being made by others to re-organize this venture. Six miles north of Santa Rita is Georgetown, where two or three small leases are in operation on a dry silver ore. A carload of 90- to 100-oz. ore every other month is the aggregate output. It is reported that Al. Owens talks of resuming work at the Royal John mine in the Black Range, 35 miles north of east from Santa Rita, if the price of lead continues good, which seems likely. The ore is a mixture of galena and blende, yielding a 40 to 45% lead concentrate and a zinc concentrate of similar grade. The mill has a daily capacity of 100 tons.

The United States Smelting, Refining & Mining Company, by its subsidiary, the Hanover Bessemer Iron & Copper Co., is exploiting the magnetite deposits of Fierro, three miles north of Santa Rita. The company is employing 100 men and producing 1500 tons of ore weekly under the management of L. M. Kniffen. The workings are down to 650 feet, but most of the output comes from the 300-ft. level. The ore averages 35% iron and is put on the cars at a cost of $1.25 per ton. It is shipped to the Colorado Fuel & Iron Company's plant at Pueblo. The Empire Zinc Company, controlled by the New Jersey Zinc Company, has mines at Hanover, 1½ miles below Fierro, but they have been idle since April of last year.

In the Mogollon district, the old Fanny mine is being worked by the American Silver Corporation, employing 40 men and producing a silver-gold ore that is treated in a 20-stamp mill. At Silver City, "the biggest little city in the world", L. A. Goodier is employing 50 men digging manganese ore on Boston hill. He is shipping 300 tons daily to Pueblo, Colorado. Near Lordsburg, the Calumet & Arizona Copper Company is exploiting its recent purchase, the 85 mine. Three hundred men are employed, producing a low-grade siliceous copper ore, containing a little gold and silver, for shipment to the company's smelter at Douglas, Arizona.

At Cerrillos, the Santa Fe Gold & Copper Mining Co., identified with the Lewisohns, has mines and a smelter, but these are operated only when the price of copper is high; so they are idle now. The mine is at San Pedro and the smelter is on the railroad at Cerrillos. At Pinos Altos there is talk of driving a 2½-mile adit to cut sundry veins, including the Pacific and Langston, at a depth of 300 feet, but this would be above the existing workings, so the project is meeting with adverse criticism. At Magdalena, the old Graphic mine continues to be operated by the Ozark Smelting & Mining Company, under the management of P. H. Argall. The monthly output consists of 10 carloads of lead concentrate, which goes to the El Paso smelter, and 15 cars of zinc concentrate, which is shipped to Coffeyville, Kansas, for the making of pigments by the Sherwin-Williams Company.

New Mexico's coal industry is affected by the strike, but only to a minor degree. At Raton, near the Colorado line, two companies are operating, the St. Louis & Rocky Mountain Co. and the Stag Canyon branch of the Phelps Dodge Corporation. Each company is working two days per week. At Cerrillos, near Santa Fe, the Albuquerque & Cerrillos Coal Co. is operating its bituminous mine two days in the week and its small anthracite mine continuously, under the management of George Kaseman. At Gallup, in the western part of the State, the Gallup American Coal Co., which is operated jointly by the Chino Copper and the American Smelting & Refining companies, is working full-time producing 6000 tons per week under the superintendence of Horace Moses and the direction of Mr. Sully, the general manager of the Chino Copper Co. Another company, the Wentmore Coal Co., managed by George Kaseman, is working full-time with about one-third the normal force of workers, and producing 1200 to 1500 tons weekly. The Diamond Coal Co., with B. B. Hangar as manager, for the Pollock brothers, of Los Angeles, is producing 1000 to 1200 tons per week. The other mines at Gallup are shut down on account of the strike.

Wages at Santa Rita and elsewhere in the State, thanks to the supply of Mexican labor, are only 50 cents per shift above the pre-war rate. According to the U. S. Bureau of Crop Estimates, the cost of living in New Mexico has declined 18% during the last year. The supply of labor is plentiful.

The smelter at El Paso re-started its copper plant, to treat the Chino ore, on May 27. There is complaint of a shortage of sulphide ore, not only at El Paso but at other smelters in the West. This lack of sulphur is due to the increasing proportions of oxidized ore that is being treated by flotation and by leaching.

DISCUSSION

Deep Veins in the Appalachian Belt

Three Gold Regions in Georgia in Which Veins Have Not Degenerated Into Strings of Unimportant Lenses

THE EDITOR:

Sir—In the editorial entitled "Deep Veins" in the *Journal-Press* of June 3, page 945, you say: "It is however, to be remarked that the deep quartz veins often degenerate, as in the Appalachian Belt. . . ."

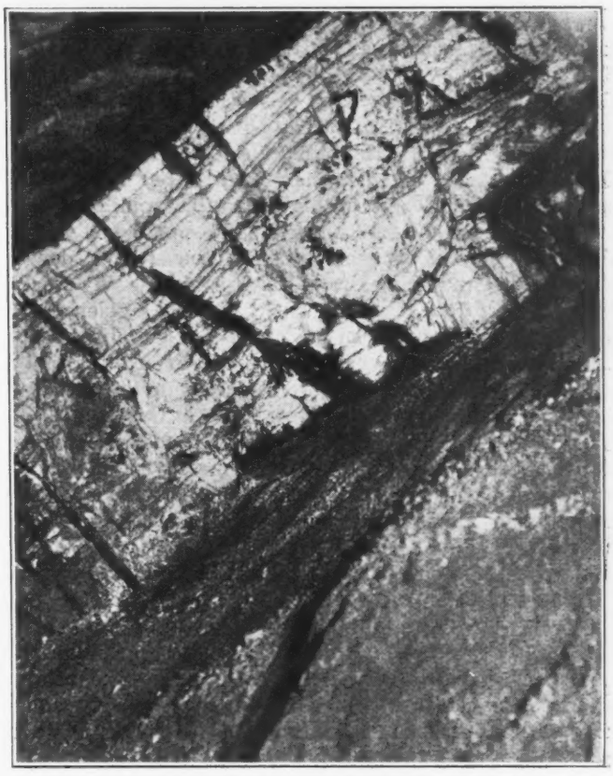
Since Becker, Lindgren and others have accepted the term "Appalachian Belt" to cover all the gold-producing area lying east of the Appalachian Mountains from Georgia to the Canadian boundary and which crosses the boundary into Ontario, making a belt nearly three thousand miles long; and since the Geological Survey has taken this "Appalachian Belt" for granted, it is not strange that we should go on using the term as a blanket for the entire area. The blanket, to be sure, is long enough, but I am not so sure that its width is sufficient.

If it is true that the veins of this belt have "degenerated" into a string of small lenses that can be counted upon for but little depth and are as hard to find as the proverbial needle in the haystack, the matter is of no importance. But, since certain mines in Canada that happen to be on this belt and in this formation have taken position with the most important gold mines of the world, it seems to me that this "Appalachian Belt" deserves further consideration.

There are three nearly parallel gold belts in north Georgia. Of the three the Dahlonega Belt is the furthest west. This is believed by E. C. Eckel and others to belong to a period not earlier than the Carboniferous. We may not all agree with Mr. Eckel, but there is evidence in support of his opinion. However, there is no doubt that the veins of the McDuffie Belt, which lies furthest east, are of Pre-Cambrian origin, nor that the veins of the two belts differ about as widely as the ages of the Carboniferous and pre-Cambrian rocks.

In the Dahlonega Belt the veins conform entirely to the strike and dip of the country rock, which is about N. 50 deg. E., dipping to S.E. There are no faults or other evidence of crust movement since the formation of the veins. These veins consist of many roughly parallel stringers and lenses with intercalated country rock. The thickness, which is from 10 to over 50 ft., can be determined only by assay, as the walls cannot be relied upon. Now and then may be found what seems to be a well-defined wall, but assays will show that this has no influence on the values, which may extend beyond or may not reach it. The gold seems to be impartially distributed in quartz stringers and country rock within the vein, but is sometimes concentrated along the edges of these stringers where a small amount of ore will run into the hundreds, or even thousands, of dollars per ton. These rich "bunches" as they are called by the local miners, are misleading, as they jump from one stringer to another, and "high grading," as it is attempted there, is very unsatisfactory. If these veins are ever worked profitably it must be done on a larger scale than has ever been tried in Georgia, and the vein taken as a whole. This will reduce the value of the ore to about $3 per ton, but will vastly increase the tonnage.

In striking contrast to the stringer lodes of the Dahlonega Belt is the vein shown in the accompanying photograph. This photograph was taken by B. M. Hall & Sons to accompany their report, dated April 30, 1920, on the Columbia mines of McDuffie County, Ga., and shows a typical McDuffie Belt vein.



Typical gold-bearing vein in McDuffie Belt, Georgia

These veins are of massive or "bull" quartz and vary in thickness from 2 to about 20 ft. They have well-defined walls and are usually separated from the country rock, which may be hydromica schist or gneiss, by a few inches of gouge. All the gold is within the quartz vein and within the walls. Sometimes a smattering of iron pyrites is found in the wall rock, but it never contains more than a trace of gold and is usually barren. The general strike of the country rock is N. 52 deg. E. and the dip is about 60 deg. N.W. but, with one exception that I know of, the richest and strongest veins cut this formation, striking either north

and south or east and west. The north-south veins are vertical, whereas the east-west veins dip about 45 deg. north. Faulting is not rare, and there is abundant evidence of wall movement. Free gold, auriferous pyrites, both iron and copper, and galena are the principal metals found in the ore. The Dahlonega veins contain only gold and iron pyrites, with a trace of copper in some localities.

As to "degeneration": I have selected this photograph because I have followed this particular oreshoot from the surface. The Columbia vein strikes east-west, dips 45 deg. N., and this pay shoot, which is nearly 300 ft. long, pitches about 60 deg. E. At the surface it was a "honeycombed" vein 18-in. thick and milled $10.50 per ton in a stamp mill. At a depth of 150 ft. it was 6 ft. thick and assayed $19. At 350 ft. depth it was 21-in. thick and assayed $10.60. At the point photographed, which is 20 ft. above the 450 level, it is 40 in. thick and assays $13.25 in gold.

The 450 level referred to is the lowest level, or drift, from the Incline shaft on the Columbia property and is the deepest shaft on the McDuffie Belt. This level extends 460 ft. west from the shaft on the vein, which has an average thickness of 52 in. and an average value of $8.20 per ton in gold. Nine hundred feet west of the Incline shaft, which has a vertical depth of about 312 ft., another shaft of nearly equal depth shows this vein to be 6 to 8 ft. thick and the value to be $16.75. On the surface this vein has been traced for three-quarters of a mile, and all of it contains gold.

These veins—you call them lenses—pinch and swell along the strike, but the oreshoots have gone down with consistent thickness and value as far as any work has yet been done. Where, then, is there evidence to show that "a lense opened up at the surface pinches at a little depth"; and why should "deeper exploration" be more speculative on the vein shown in the picture than if this photograph had been made in California?

I understand fully that a depth of 312 ft. is not deep mining; I also know that the clean record of this vein and of other veins here cannot be accepted as proof that the veins continue to great depths. Yet I do not know why they should not, and, with the facts before me, I do not believe that it can be taken for granted that the veins are small lenses of no economic importance.

I might have selected any one of a number of veins here for the purpose of this letter, but this Columbia vein has been made conspicuous recently by the utter failure of a company which leased the property and tried, without sufficient labor, supplies, or funds, to develop it during the period of the war. The history of this attempt is a matter of record and furnishes abundant proof that the mine was in no way responsible for this failure.

W. H. FLUKER.

Thomson, Ga.

We note the following in our contemporary the *South African Mining and Engineering Journal* of April 22, 1922, and express our appreciation:

"The *Mining and Scientific Press* has been sold to the McGraw-Hill Co., Inc., New York., and will be consolidated with the *Engineering and Mining Journal*. The first issue of the consolidated papers appeared on April 1 as the *Engineering and Mining Journal-Press*. We extend to our augmented contemporary hearty congratulations on this consolidation of two most valuable mining periodicals, and wish the *Engineering and Mining Journal-Press* all good fortune in the future."

The Harmony of True Science and True Religion

THE EDITOR:

Sir—In the July 1 issue of the *Journal-Press*, on p. 1, the editorial entitled "The Trespassing of Religion on Science," brings to mind a discussion that has recently appeared in some of the daily papers of this locality. I enclose a clipping from the *Charlotte Observer*, which will express in a measure the cause of such an attack mentioned in the editorial referred to. The clipping is an expression of profound ignorance of science, but clings tenaciously to a religious belief in which the sulphurous fume of hell's fire is the principle to be reckoned with in God's plan. Much of the argument of the clipping may be discarded, but the serious aspect is the contemplation of the effect upon the lay reader of the paper. This argument began with an address by one of the professors of a denominational college in the state when he spoke of the origin of man, which resolved into the idea of evolution from the monkey. Some of the expressions of the clipping concerning this subject are amusing and at the same time serious because of the feeling engendered against the findings of scientific investigation and research. I did not read the original address but feel there was a misunderstanding as no reputable scientist would venture a statement to the effect that man is a product of evolution from the monkey. If such was the case, evolution was stopped and the Divine plan was a failure; but since there can be no failure in the plan of the Almighty, we must reckon on some other source of man's origin, and attribute it to its proper place and circumstance in the cosmological order.

The biblical account merely dwells on the fact that man was created as the last of the great animal families. Geology has proven this to be the fact and offers no conflict, only substantiates the fact; nor have any fossil remains been found to cause belief of any intermediate connection between mankind and monkey. At the time the clipping was published, I had a conversation with a clergyman when the argument was mentioned and he asked my views of the matter. To which I replied that man was neither a monkey nor a larva but the direct creation of God, by His method of creation as a superior and distinct species conforming with the progress of life on the earth, and stated further of the work of geological investigation and conclusions based on their considerations. He then asked if there was any conflict with the Bible, whereupon I quoted from the 3rd edition of J. D. Dana's Manual of Geology, page 604, fourth paragraph. He was convinced that science still held God above Nature.

I have written this not especially for your edification, but I feel as you do in the matter, that there is need of an understanding between the theologians and scientists, expressed in such terms as will convey clearly, yet couched in language plain enough to be understood by the intelligence of the masses, as they will be the most effected. In this section of the country the Bible is divine law, which it should be, and is believed in from "cover to cover," and any statement which sounds different has no consideration. The biblical statement of Adam being the first man is regarded as basic fact. When a statement is made to the effect that records have been recovered by archaeologists that antedate the theologic date of creation, they are discarded as a machination; and it keeps the multitudes in suspense

wondering where Cain found his wife, and what her personal appearance was. I have mentioned these instances because of their remote age, and also to convey an idea of the detail which must be made plain to create harmony between the contending parties. I believe further that if in connection with the studies of the Bible as God's holy law, a book were written to explain the process of the progress of life, as well as the methods of world building employed by the Creator, which have been revealed to geologists and other scientists by their study of the rocks, much would be done to place religion on the high plane where it belongs, and dispel the superstition which appears today in the guise of religion. Cosmic beauties would be more in evidence, present happiness more appreciated, and future punishment be less an object of dread.

This is not intended for a sermon, but as an expression to do its share toward reconciliation of the two sciences, which mean so much to mankind, and I feel the *Journal-Press* is the most fitting medium to begin such a plan of education. THOMAS SMITH.

Gold Hill, N. C.

Assaying Without Chemicals

THE EDITOR:

Sir—In the May 27 issue of *Engineering and Mining Journal-Press*, there appeared an article entitled "Assaying Without Chemicals" dealing with the determination of copper in mattes by means of specific gravity. The table which accompanies this gives the

ANALYSES AND SPECIFIC GRAVITIES OF MATTES.

Company	Per Cent Copper	Per Cent Iron	Per Cent Sulphur	Per Cent Lead	Per Cent Zinc	Sp.Gr.
8	53.10	17.50	22.82	....	....	5.00
7	51.85	22.48	22.96	....	....	4.89
12	43.48	30.60	25.36	....	....	4.50
2	42.92	27.80	24.84	....	....	4.69
3	42.65	27.30	23.79	....	....	4.89
4	41.46	24.34	22.12	....	....	5.00
10	40.92	35.85	22.88	....	....	4.50
11	37.27	33.72	22.95	....	....	4.66
19	35.08	36.10	23.48	....	....	3.82
1	34.99	34.34	24.87	....	....	4.66
17	33.72	38.52	24.08	....	....	4.40
5	30.50	38.13	23.91	....	....	4.13
9	25.61	44.12	21.71	....	....	4.66
13	20.14	48.22	24.66	....	....	4.13
16	42.15	1.38	15.69	34.78	....	6.66
4	41.46	24.34	22.12	....	3.62	5.00
6	4.92	47.91	23.12	5.11	7.46	4.26

analyses and specific gravities of seventeen commercial mattes. These matte samples were obtained from various smelters, some in this country and some in Mexico. It would appear from the data that there is very little relation between the copper content and the specific gravity. The table has been prepared by M. H. Thornberry and myself. CHARLES Y. CLAYTON.

June 30, 1922.

Thought for a Rainy Day

THE EDITOR:

Sir—A number of suggestions have been made tending to an increased use of copper. Why not encourage the manufacture of umbrellas with copper ribs and fastenings—all the metallic constituents of the umbrella to be made of copper?

We invest $5 in a so-called first-class umbrella, use it half a dozen times, and then on opening it find that oxidation has done its work, and one or two ribs stick through the cloth material.

Here is room for improvement, and I shall patronize the first corporation turning out a perfect umbrella with all metallic parts made of the red metal.

Harrisburg, Pa. HENRY C. DEMMING.

Milling Braden Ore in 1921

The following data taken from the annual report of the Braden Copper Co. summarize the more important figures concerning milling operations during the last two years:

	1920	1921
Total dry tons milled	2,205,200	732,069
Average dry tons milled per calendar day	6,025	2,006
Per cent copper in mill feed	2.078	2.256
Per cent copper in mill tailing	0.501	0.358
Percentage of copper recovered	77.28	85.58
Percentage of plus-65 mesh in tailing	5.5	2.10
Dry tons concentrate shipped	179,353	56,489
Per cent of water in shipments	16.69	15.27
Per cent of copper in shipments	19.49	25.47
Per cent of "insoluble" in shipments	20.86	19.29

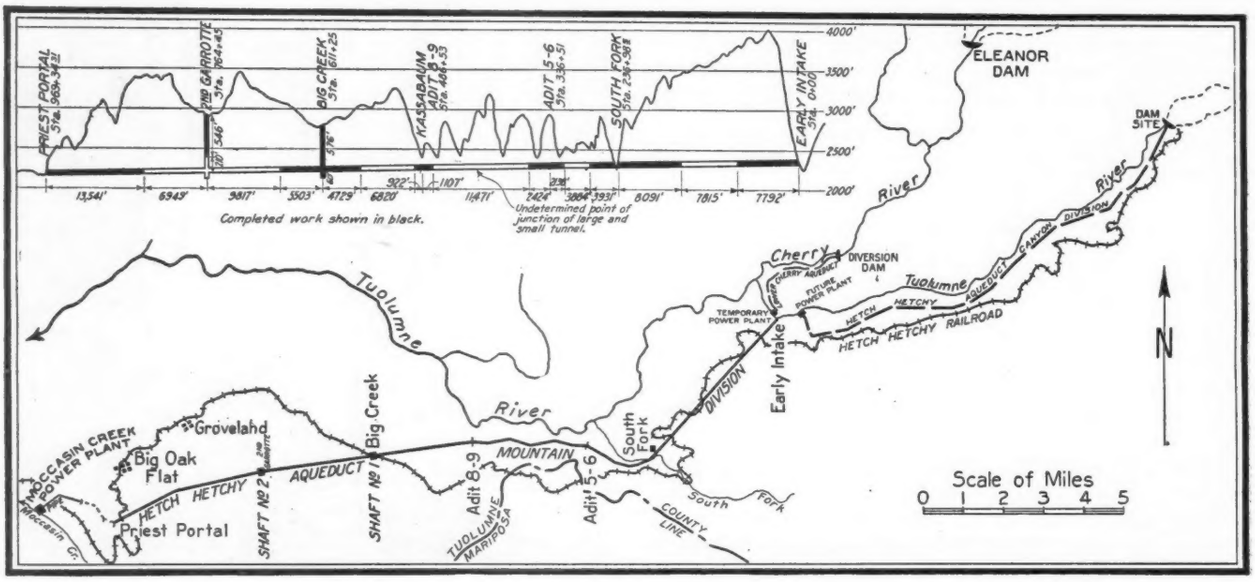
The comparative purity of the concentrate is at once apparent, and was due to the different mineralization of the ore mined and a decided improvement in the flotation practice. The grinding performed by the Marcy and Hardinge mills, as shown by the small percentage of oversize, was the finest achieved to date. The new crushing plant started in July.

Driving an Eighteen-Mile Tunnel Through the Sierra Nevada

Details of the Methods Used in Operations on the Mountain Division of the Hetch Hetchy Aqueduct That Is to Supply San Francisco With Water—Organization of the Work—Record Established for Rapid Progress—Costs

By Arthur B. Parsons
Assistant Editor, *Engineering and Mining Journal-Press*

During the month of August, 1921, the Priest heading of the Hetch Hetchy aqueduct tunnel, now being driven by the City of San Francisco through the Sierra Nevada in Tuolumne County, Cal., was advanced 776 ft. So far as I know this establishes a new record for rapid progress in tunnel driving. In any event, the performance was remarkable; it leaves no room for doubt as to the competence of the engineers in charge. Not only have they selected suitable equipment and machines, but they have organized their men effectively; they have made wise choice of methods, and they have systematized operations so that efficient work is possible. Although the cross-section of the tunnel is slightly larger than that of even the main haulageways generally driven in metal mines, the operations are essentially those of mining, and for that reason some details of the work should be of interest to mining engineers.



Map of "Canyon" and "Mountain" divisions of the Hetch Hetchy Aqueduct project. Profile of the eighteenth-mile aqueduct

Purpose of the Hetch Hetchy Project

The Hetch Hetchy project has for its ultimate purpose the supplying of 400,000,000 gal. of pure mountain water per day to four million people in the metropolitan district of San Francisco; and, in addition, the development of 200,000 hp. of hydro-electric energy for distribution in the industrial districts tributary to the Bay cities. Since 1916 the City of San Francisco has constructed a winding standard-gage branch railway sixty-eight miles long to handle the material required for the mountain division of the project; and it has built a 70-ft. dam at Lake Eleanor, to supply water for a 4,500-hp. plant that generates the power required for construction activities. Work at present is centered on the erection, at a cost of $6,000,000, of the principal dam across the channel of the Tuolumne River at the mouth of Hetch Hetchy valley, and on the driving of the eighteen-mile tunnel that is to carry the water from Early Intake, twelve miles below the dam, to Priest Portal, which is just above the site of the Moccasin Creek power house, where preliminary work is under way for the erection of a 60,000-kw. generating plant. Income from the sale of the electric energy generated here will aid materially in financing the construction of the remaining 135 miles of tunnel and steel-pipe aqueduct that is to carry the water to San Francisco. For this reason it is important that the driving of the eighteen-mile tunnel be expedited as much as practicable.

The work is being done under a special form of contract with the Construction Company of North America, of which C. C. Tinkler is president and manager. A. C. Dennis and Frederick Wilson have a sub-contract for the driving of the westerly part of the tunnel. The engineers in charge of the work, to whom is due much of the credit for the efficiency of operation, are on the staff of M. M. O'Shaughnessy, City Engineer for the

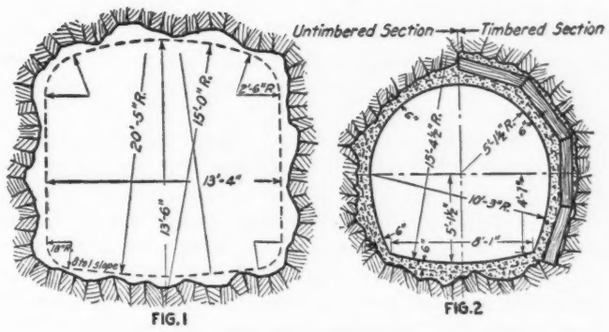


Fig. 1. Section of large heading. Fig. 2. Section of smaller heading

municipality of San Francisco. L. T. McAfee is construction engineer for the mountain division, with headquarters at Groveland, and J. H. Ryan is his principal assistant. N. A. Eckart, chief assistant engineer for the project, is stationed at San Francisco, but devotes most of his time to the work. I also wish to mention A. J. Wehner, assistant engineer at Groveland, to whom I am indebted for the detailed information that I obtained on the occasion of a brief visit to Groveland in February.

Driving Done From Eight Different Headings

Naturally, the element of time as well as the economical disposal of the excavated material made it necessary to arrange for driving headings from intermediate points between the two extreme portals at Early Intake and Priest; in fact, one of the considerations that determined the exact line of the tunnel was the necessity for providing suitable points for this work. At present there are eight headings in addition to the terminal portals, and two more will be available when the Second Garrotte shaft is completed.

The sketch in the upper left-hand corner of the map shows the principal features of the profile; it should be borne in mind that the course of the aqueduct is a meandering line, a fact that does not appear on this sketch. At South Fork the aqueduct will cross the canyon, so that there are two portals from which tunneling is being performed in opposite directions. At two points adits, 80 and 220 ft. long respectively, have been driven from the face of the mountain to the line of the tunnel, where headings have been started in each direction.

The camps, including living quarters, boarding house, office, compressor plant, and shops, at the portals of these auxiliary adits, are known as Adit 5-6 and Adit 8-9. The absence of the other numbers may arouse curiosity. The explanation is that the tunnel was divided into eleven sections by the points at which it was practicable to start headings either immediately on the course of the tunnel or through shafts or auxiliary adits. It has been found unnecessary to begin operations at all of these points. Section 3, for example, will be driven from South Fork and Section 4 will be driven from Adit 5-6.

At Big Creek a three-compartment shaft has been sunk 576 ft. to the tunnel grade, with about 75 ft. additional to provide a storage bin and loading pocket for handling the rock, a sump for catching the water, and a station for the pumps. The two headings are known as Big Creek East and Big Creek West, just as the headings at Adit 8-9 are known as 8-9 East and 8-9 West. The shaft at Second Garrotte is now more than 600 ft. deep. It will reach grade at 757 ft., and the sump will make it at least 800 ft. deep. The sinking of this shaft is an interesting story in itself, on account of the difficulties occasioned by cutting a number of large watercourses. As much as 1,600 gal. per minute has been pumped from the shaft for weeks in succession. Section 11 is the part of the aqueduct that starts from Priest Portal.

Two Different Types of Tunnel

Two different types of tunnel are being driven; the junction will be somewhere between Adit 8-9 and Adit 5-6, the exact point depending upon the character of the ground yet to be driven through. East of the junction the ground is hard, tough diorite, quartzite and granite; the most easterly sections pass through a monolithic granite that is remarkable for its solidity and toughness. West of Adit 5-6 the ground becomes softer; diorite is accompanied by an "altered slate," as it is described by Mr. Tinkler, and in Priest Portal a medium-hard schist takes the place of the diorite.

The original plans provided for the lining of the entire aqueduct tunnel with concrete. However, after driving several thousand feet from Early Intake it became apparent that the granite was so firm, so tough, and so little affected by water that a lining would be superfluous. Although a tunnel of larger cross-section would be required on account of the increased friction arising from the irregular surface of the walls of bare rock, the additional cost of excavation was more than offset by the saving on concrete. Accordingly, the easterly half of the tunnel will be unlined.

Details of the Tunnel Design

The accompanying illustrations, Fig. 1 and 2, give details of the standard tunnel, both lined and unlined. The drawing for the lined tunnel shows the requirements for timbering in the parts that need support. I may say, however, that not more than about 800 ft. in the five miles already finished has required any support from timbers. It will be noted that the cross-section of the unlined tunnel is almost a square, although the standard design provides a slight arch in the back as

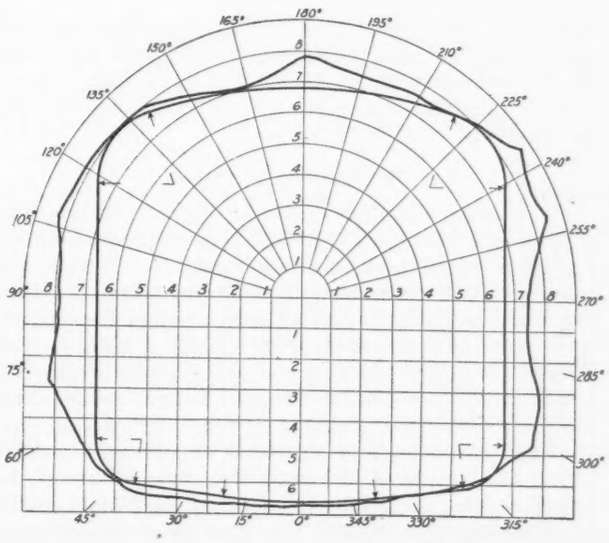


Fig. 3. Typical section of the large tunnel as broken

well as a "dish" in the floor. The square tunnel is more easy to break than that of the "horse-shoe" or round section, and the rock is sufficiently firm to make considerations of structural strength of secondary importance. In general, then, the two types of heading may be described as a square with minimum dimension 13 ft. 4 in., and a circle with a minimum radius 11 ft. 3 in.

Overbreak in the square tunnel is not important, except that it entails the handling of unnecessary rock, whereas the contractors are penalized for excessive overbreak in the round tunnel for the reason that the space must subsequently be filled with concrete. Accordingly, special effort is made to keep within the prescribed lines as nearly as practicable. Fig. 4 shows the ideal line of excavation for the larger tunnel and the actual line at one point in Adit 5-6 East heading. These sections are taken at intervals of 5 ft. along the line of the tunnel; the particular one shown, having an overbreak of 25.2 sq.ft., was selected because that was the average overbreak in that heading for the month of November, 1921.

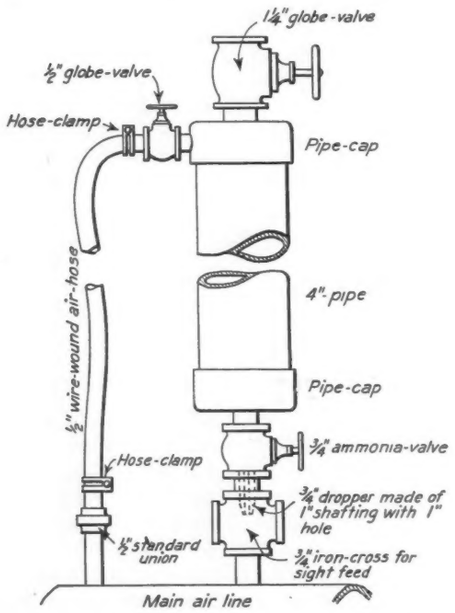


Fig. 4. Device for feeding lubricating oil into air line

The gross area of the section as excavated was 193 sq.ft.; the ideal area is 167.8 sq.ft. Thus the overbreak is almost exactly 15 per cent. The light lines indicate blue lines on loose-leaf sheets that are used for the field notes of the tunnel survey.

Compressor Equipment

The standard equipment for all but two of the compressor plants is the Laidlaw-Dunn-Gordon 15-9½-12 two-stage compressor, with a capacity of 675 cu.ft. per minute. Each compressor is connected through a Lennix drive to a 100-hp. Allis-Chalmers induction motor. Two such units are installed at Early Intake, two at Second Garrotte, and three each at South Fork, Big Creek, and Priest Portal. Ingersoll-Rand compressors are used at Adit 5-6 and at Adit 8-9, the two plants being identical. Each is composed of two machines of 700 cu.ft., and one of 500 cu.ft. capacity. All are of the Imperial type, and all are driven through Lennix drives by Westinghouse motors. A slow-speed steam compressor made by the Ingersoll-Rand Co. is installed at Second Garotte to supply power for operating emergency pumps in the event that electric power fails. Boilers are always maintained under steam, for reasons that are clear when it is recalled that the shaft "makes" 1,500 gal. of water per minute.

Though comparatively small, these plants were all erected carefully, and the machines are maintained in first-class condition. There is ample capacity to meet the requirements, and the air lines do not leak. The result is an adequate supply of air delivered at the face at standard pressure. This is one of three important essentials for efficient drilling; but it is astonishing how frequently, in mines that are supposed to be well managed, time is wasted because of lack of air at the proper pressure. When in the course of one month in a single heading more than a hundred rounds are drilled, each consisting of twenty-five holes ten feet deep, the conditions must be right.

The other two of the three essentials I have mentioned are drills that are given intelligent care, and steel that is properly sharpened and supplied in adequate quantity. Some rock drills are better than others; some do better work in certain kinds of rock than they do in other kinds; but most of the standard drills will do good work if they are cared for properly, and the best-made drills will do mediocre work if they are abused. Abuse of a rock drill does not mean working it steadily or even throwing it around; it means, in the first place, running it without proper lubrication, and afterward running it with parts that are worn out. Of course, if the drill is oiled as it should be the moving parts will not need to be replaced so soon. On the Hetch Hetchy work the drills are taken to the shop after every shift and are inspected, and repaired if necessary; and, in any event, they are cleaned and oiled thoroughly before being returned to the heading. No drill is sent to the face unless it is in condition to operate efficiently. The result of this policy is effective drilling; but the repair cost is unusually high. This can be accounted for only by failure to oil the machines properly while they are being used. The following figures are informing:

TABLE I. COST OF REPAIRS—MATERIAL ONLY—INGERSOLL-RAND "248 LEYNER" DRILLS.

Camp	Period, Months	Cost Per Foot of Advance	Cost Per Ton of Rock
Early Intake	12	$3.29	$0.173
South Fork	12	1.51	.079
Adit 5-6	7	1.64	.086
Big Creek	12	1.95	.156
Priest Portal	12	1.09	.087

Care of Rock Drills

Allowance should be made for the fact that Early Intake is in tough, massive granite that subjects drills to particularly severe service; more holes per pound are required to break the ground, and the character of the rock necessitates more blows per foot of hole drilled. On the other hand, the rock at South Fork is much harder than at Priest Portal, and yet the cost per ton of rock excavated is less. This may indicate either better oiling at South Fork or possibly a tendency to allow worn parts to remain longer in the drills; in the latter case, the efficiency of drilling would decrease.

For this difficulty there is but one remedy. Mine superintendents know that drill runners as a class will not oil their machines as they ought to be oiled; their object is to "get in the round" on which they are working. They do not worry about the next shift or about the life of the drill. The alternative for the superintendent is to see that the machines are oiled in spite of

the runner. This can be done by introducing oil into the air line at a sufficient distance behind the distributing manifold to allow the oil to become atomized. The plan has its objections; oil is deleterious to rubber, and oil-laden air shortens the effective life of the hose through which it passes. However, this shortcoming is more than offset by the decreased wear on the drilling machines.

Fig. 4 illustrates the details of a device that has lately been placed on the main air lines in some of the headings; they have been connected at points about 200 ft. from the face. This oiler was originally made for use by the Ulen Contracting Co. in driving the Shandaken tunnel, on the Catskill aqueduct, for the New York City water-supply system. This tunnel project, incidentally, is similar to the Hetch Hetchy project in that the length is about eighteen miles and the cross-sectional size is approximately the same as that of the Hetch Hetchy aqueduct. The economy effected by the Ulen company has been so important and so positive that there can be no question as to the merit of the plan.

Ingersoll-Rand "248 Leyner" drills have been adopted as standard and are used at all camps except Adit 8-9, where "DX61" drills, made by the Sullivan Machinery Co., are in use. In addition to the "248 Leyner" the Denver Rock Drill Co.'s "Dreadnaught" is used in sinking the Second Garrotte shaft.

Highest-Priced Steel is "Cheapest"

Drill steel is the next important item to consider; 1¼-in. hollow round is employed exclusively. At the present time three different brands are being used, among which there is little to choose. Many manufacturers naturally desire to have their product accepted; and to avoid experiment with material that has not real merit the following conditions are imposed upon any company whose steel is given a trial: A complete set of new drills is prepared and used exclusively in a given heading for the period of the test, which is usually a month or more. At the end of the test the exact consumption of steel is determined and the cost of the steel used per foot of advance is calculated. If this cost fails to approach within a prescribed limit the standard unit cost for steel in the particular heading, the vendor must make good the difference and must also take back the drills that have been made up. If the standard is equaled or bettered, the steel is accepted and a regular order is placed; in either event the city pays no more than the arbitrary standard that has been fixed as the reasonable cost for steel in the particular heading. Moreover, the manufacturer will not undertake the test unless he has confidence in the ability of the steel to do the work.

The price per pound of the steel does not concern the engineers for the city; they are interested in the cost per foot of advance. It is significant that the higher-priced steels are the only ones that meet the requirements; high cost per pound accompanies low cost per foot. Steel lengths begin with 4 ft. for starters and increase by 2-ft. steps to 12 ft. for the smaller tunnel and to 16 ft. for the larger. For the large tunnel the starters are gaged at 2⅝ in. and diminish in ⅛-in. steps to 1⅞ in., whereas the range for the smaller headings is from 2⅜ to 1⅞ in. The usual "cross" bit is used.

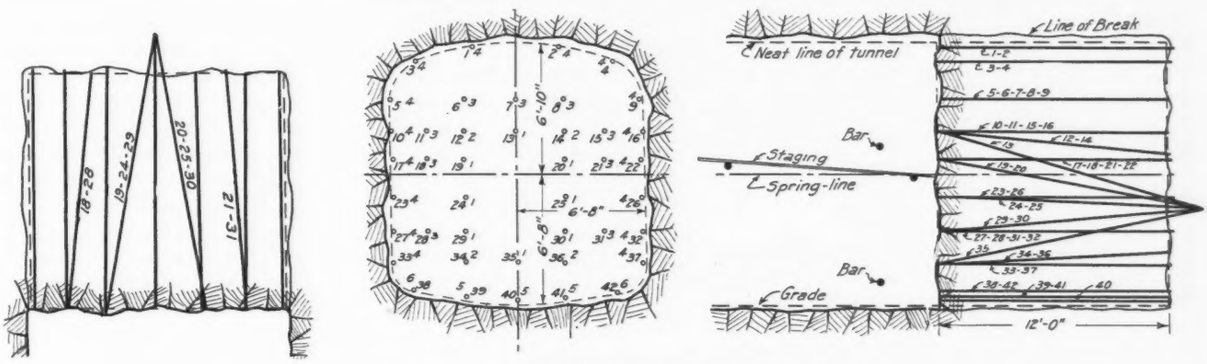


Fig. 5. Typical drill round in larger heading

The sharpening equipment for the most part is supplied by the Ingersoll-Rand Co. "I-R 5" drill sharpeners are used at Priest Portal and at South Fork, but at the newer camps "I-R 50" machines have been installed, some of the features in the design of the later machine being considered an improvement. At Early Intake and at Adit 8-9 two Sullivan "Class A" sharpeners do the work; at Big Creek one Sullivan and one "I-R 50" are used. Casual conversation with some of the operators of the sharpeners revealed the fact that a man generally contends that the machine that he first learned to operate is much superior to any other type. Both kinds of sharpeners have their advocates among the mechanics, whereas the engineers are unable to reach any definite conclusion as to the superiority of either. Heating of drill steel is done in oil-burning furnaces. Efficient drilling requires an adequate supply of steel of the proper length, accurately gaged bits, good forging and good tempering, and quality in the steel itself. These are all provided in the Hetch Hetchy work.

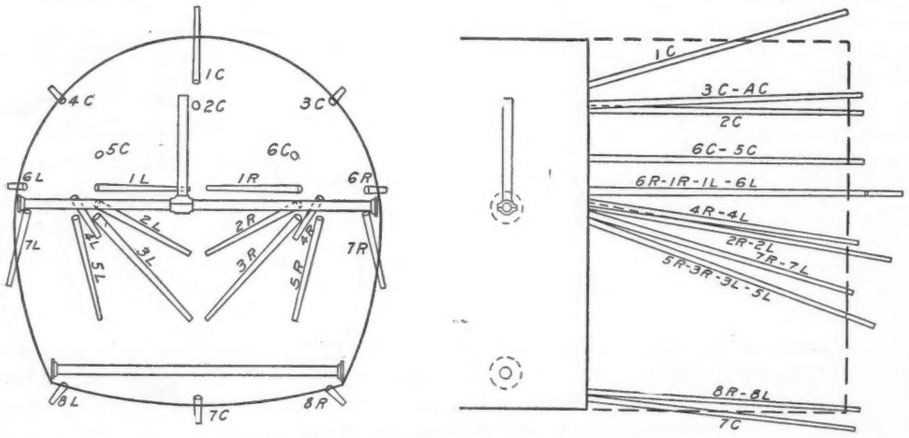
Diamond Cut for Standard Drill Round

Two standard types of drill round are used, as indicated in the accompanying drawings, Figs. 5 and 6. Both depend upon a diamond cut; the essential difference is the larger number of holes required for breaking the harder ground and the larger face. It will be noted also that in the smaller heading all but three of the holes are drilled from the upper bar, only the lifters being drilled from below. This makes it possible to do about 85 per cent of the drilling from the pile of muck in the face while the shoveling machines are in operation. This, of course, is an advantage where rapid progress is desired.

The drawings are clear; anyone interested in the subject can observe the pointing of the holes and readily

follow the order of firing. The general practice is to drill a standard round unless variations are authorized by the superintendent. He allows the men reasonable latitude to alter their drilling to meet special conditions in the face. For instance, in the round for the large-heading, holes Nos. 12, 14, 34, and 36, shown as first relievers, may be given additional slope, thereby becoming cut holes if the rock is exceptionally hard. Either more or fewer holes than indicated in the drawings may be required, although twenty-three is virtually the minimum.

A small but rather interesting point is the size of the bars. Dennis & Wilson, working in the smaller headings, use 3½-in. bars, whereas in the larger headings 4½-in. bars are preferred. All are made "on the job" of standard extra-heavy pipe. Friendly argument has arisen as to whether the bars of larger diameter would not be advantageous even in the smaller tunnel. Mr. Tinkler and the engineers for the city contend that the additional vibration of the small bar more than offsets the advantage of the added facility with which the lighter one can be moved around. They are unable, however, to convince the sub-contractors. After seeing three machines doing a "shimmy" on one of the 3½-in. bars, I am inclined to agree that the larger ones are preferable.



Typical drill-round in smaller heading

Character of Explosives in Use

Hercules and Giant gelatin dynamite are used indiscriminately, no superiority being claimed for either. Two grades are in favor: powder of 60-per cent strength only is used in the granite and granodiorite, whereas 40 per cent is used exclusively in the westerly headings. At Adit 8-9 and at Big Creek, powder of both strengths is used, depending upon the character of the particular ground that is being blasted. The proportions consumed during recent months have been approximately three-fifths of 60 per cent and two-fifths of 40 per cent. Gelatin of 80-per cent strength has been tried in places in the massive granite at Early Intake, and the superintendent there is inclined to believe that it would pay to continue the practice. The engineers, however, are convinced that ultimate economy dictates the use of 60-per cent powder, and their idea prevails. The superintendent maintains that to break the ground he must drill more holes per round than would be required if he were supplied with 80-per cent powder. Doubtless he is right; but, on the other hand, if he had 80-per cent powder he would probably overload the holes, that is, he would use more powder than necessary to insure the breaking of the ground.

Failure to Use Tamping

Here I may mention one of the few features of the work that, in my opinion, deserves criticism. This is the failure to use tamping in loading the holes; no steps whatever have as yet been taken in this direction. It has been proved to the satisfaction of competent engineers that the substitution of clay-filled cartridges for the last 10 or 20 per cent of the powder loaded will increase the effectiveness of the explosion. It is, of course, necessary to tamp the charge tightly. The reason for this seems obvious; the force of the explosion is applied effectively to the breaking of the rock, instead of being wasted. The ideal condition would be to have the explosive charge concentrated in a chamber at the bottom of the hole, the hole itself being then refilled so as to offer as nearly as possible the same resistance as the virgin rock. The object should be to approach this condition as nearly as practicable; and the use of tamping cartridges appears to be a step in the right direction. It would be interesting to experiment by loading a round of holes in the Early Intake adit with 80-per cent powder, using just half as much of the powder as would be used ordinarily of 60 per cent, and then filling the remainder of each hole with clay cartridges carefully tamped.

All the firing is done by means of electric blasting caps supplied by the California Cap Co. These are fired from a 440-v. circuit in a series of six "delays," whereby the order of firing is regulated as was shown in the diagrams of standard drill rounds. The regular procedure in the large headings is to load and fire the cut holes, suck out the fumes, and then return and load the remaining holes, with due attention to the order of firing, as regulated by the delays. "No-delay" electric caps are used when the cuts are fired separately. These should not be confused with "instantaneous" exploders. The figures in Table II include the cost of both powder and electric caps.

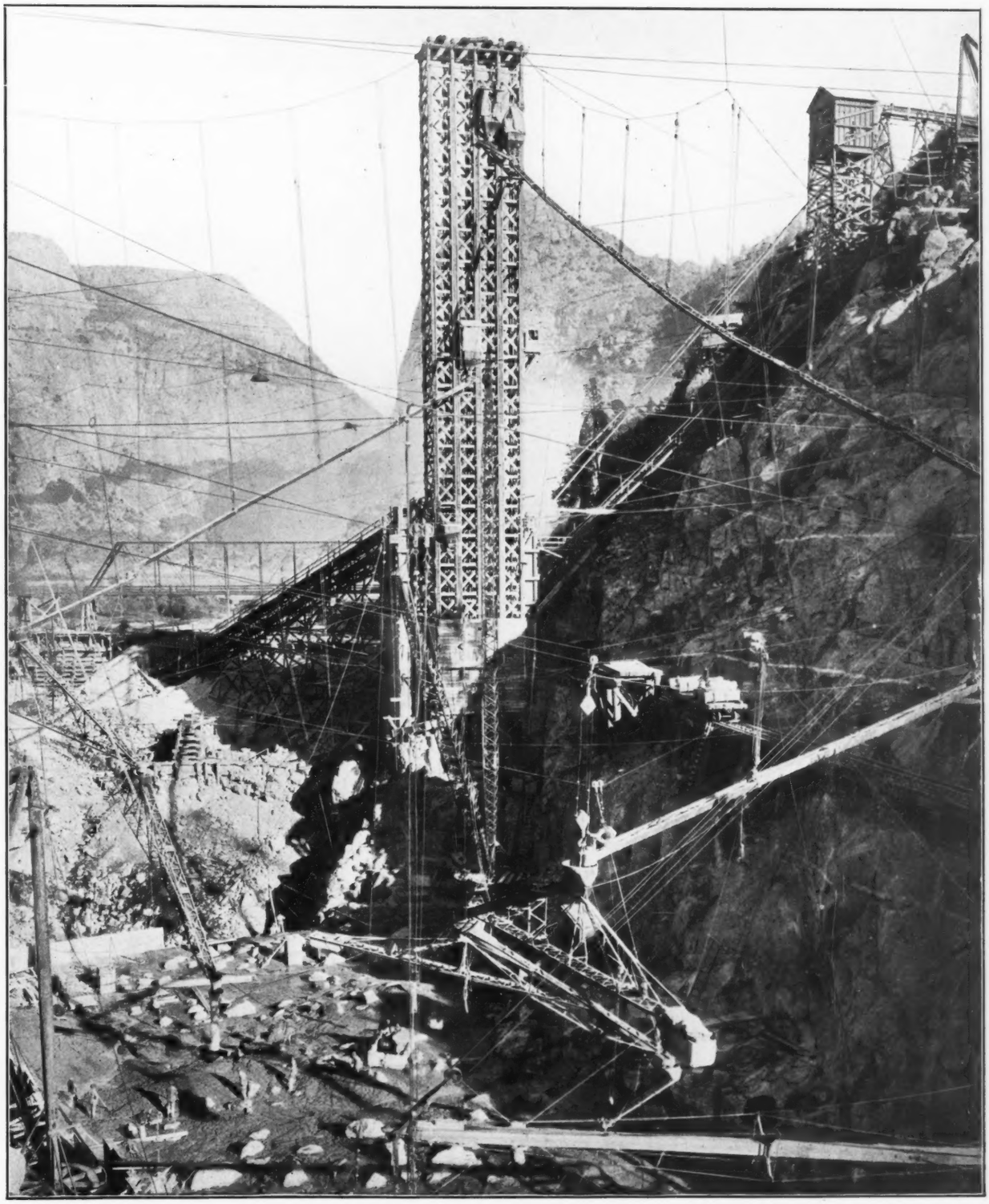
TABLE II. COST OF EXPLOSIVES DURING SIX MONTHS IN 1921.

	Cost per Foot of Advance							
	June	July	August	September	October	November	Average	Average Cost per Ton Broken
Early Intake	$12.88	$10.52	$14.31	$11.24	$9.75	$10.84	$11.59	$0.61
South Fork	10.59	9.44	8.94	8.72	10.15	10.18	9.73	.51
Adit 5-6	7.66	7.56	7.26	8.66	9.45	9.18	8.29	.44
Big Creek	7.68	5.54	9.19	8.80	8.43	7.16	7.80	.62
Priest Portal	6.83	7.51	5.33	5.65	6.31	6.96	6.43	.51

Careful Attention to Ventilation

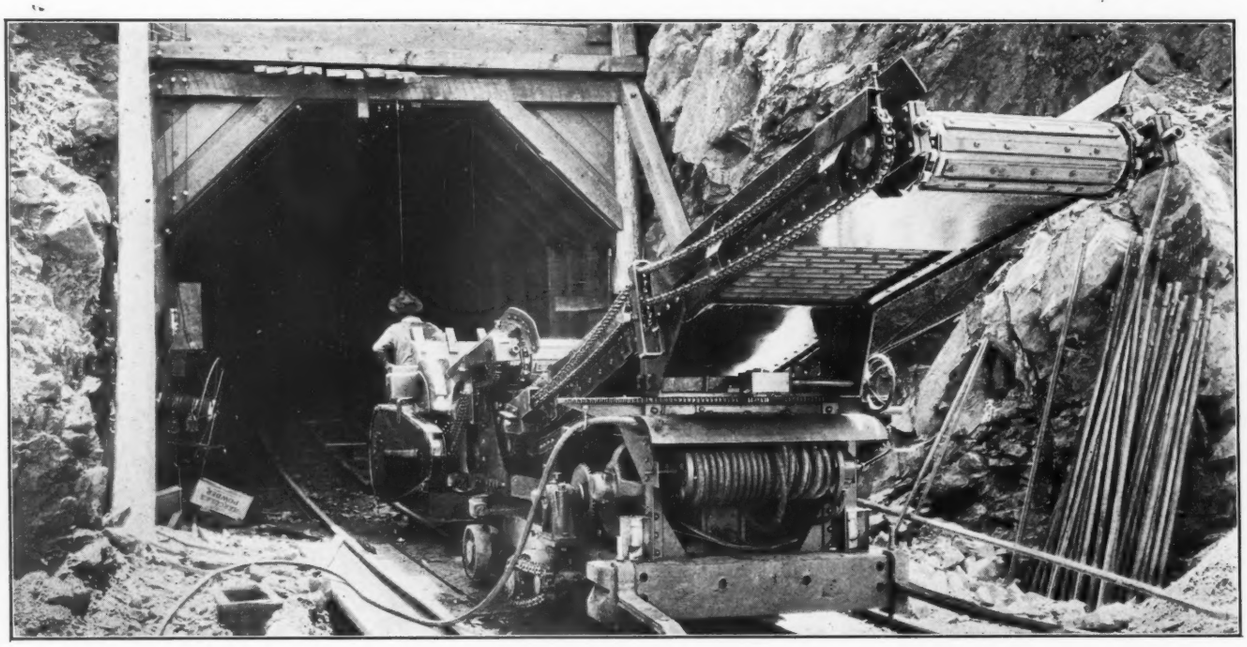
Ventilation is given careful attention. The standard machine is the No. 5½ Roots positive low-pressure rotary blower. It has a capacity of 5,000 cu.ft. of air per minute at a pressure of one pound per square foot,

Views of the Hetch Hetchy Project in the Sierra Nevada

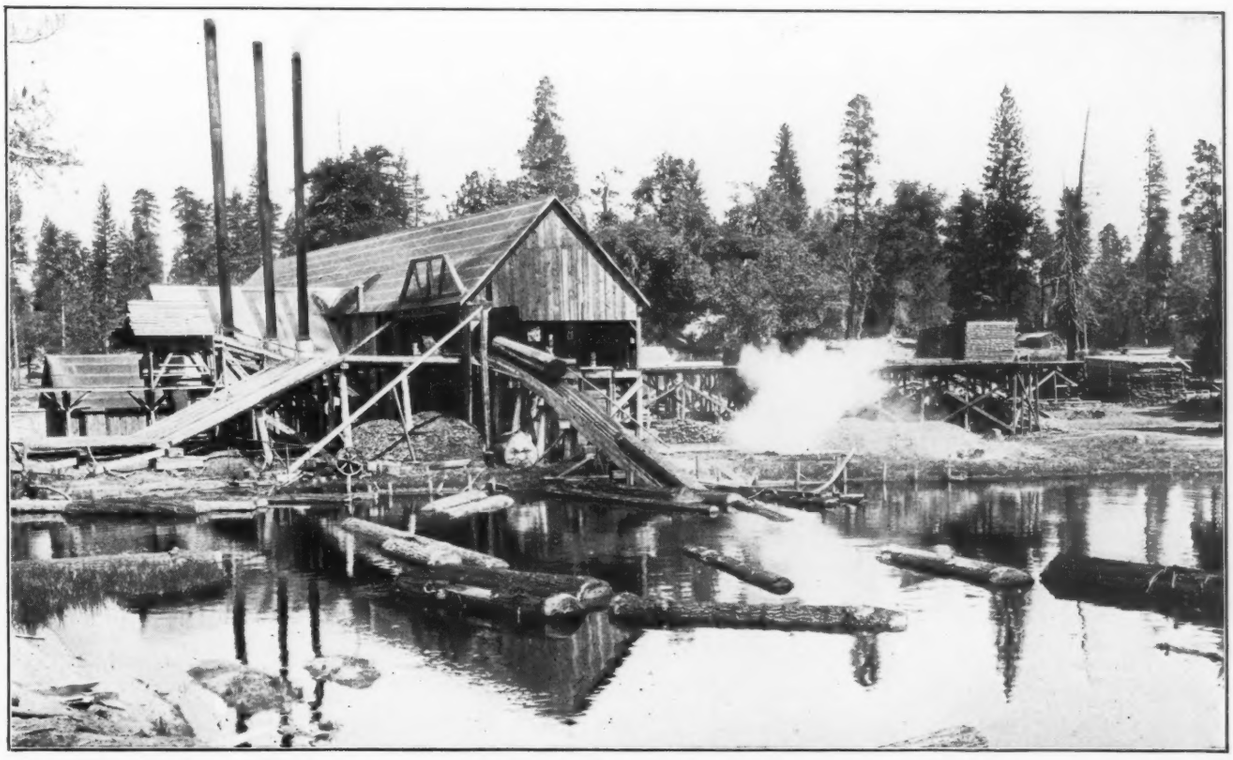


Partly completed dam that will form principal reservoir in the project of which the 18-mile tunnel is part

Railroad shops at Groveland, headquarters for the Hetch Hetchy project. A town of several thousand has sprung up in consequence of the construction work

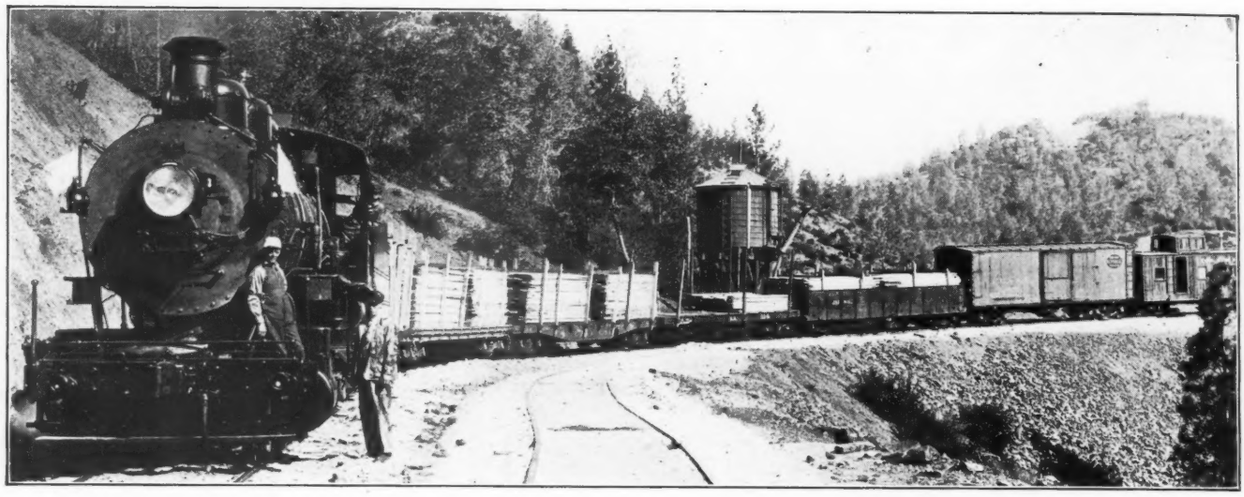


Myers-Whaley loader at the portal of Priest heading. Here, during August, 1921, the adit was advanced 776 ft., the face at the time being two miles from the portal

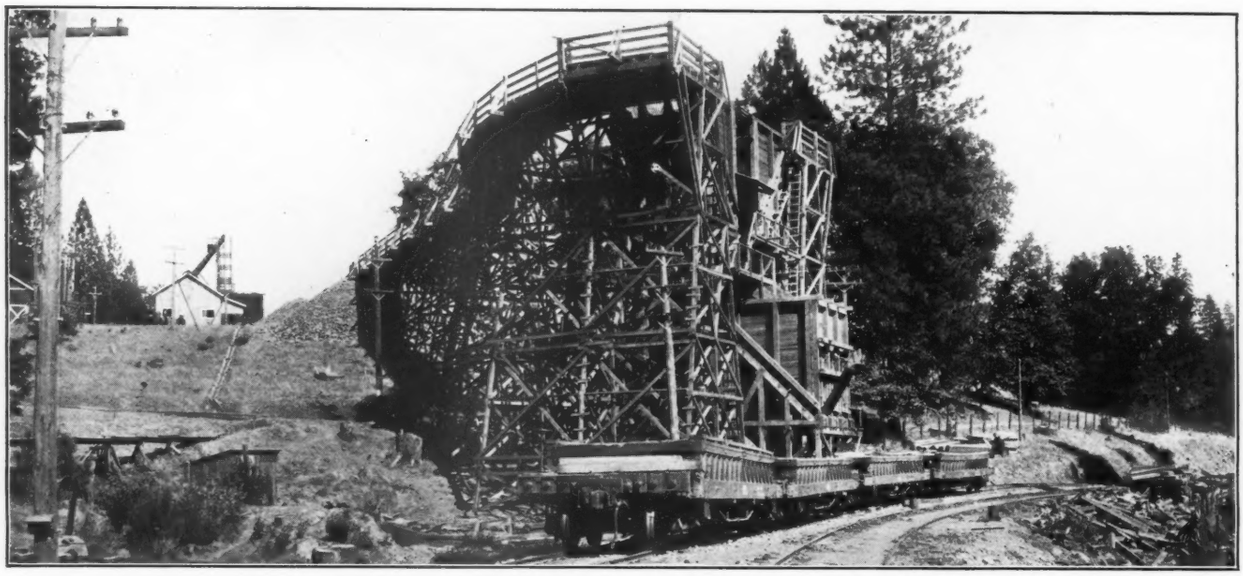


Hetch Hetchy sawmill, where all the timber and lumber for the project is cut. This has been an important factor in reducing the cost of operations

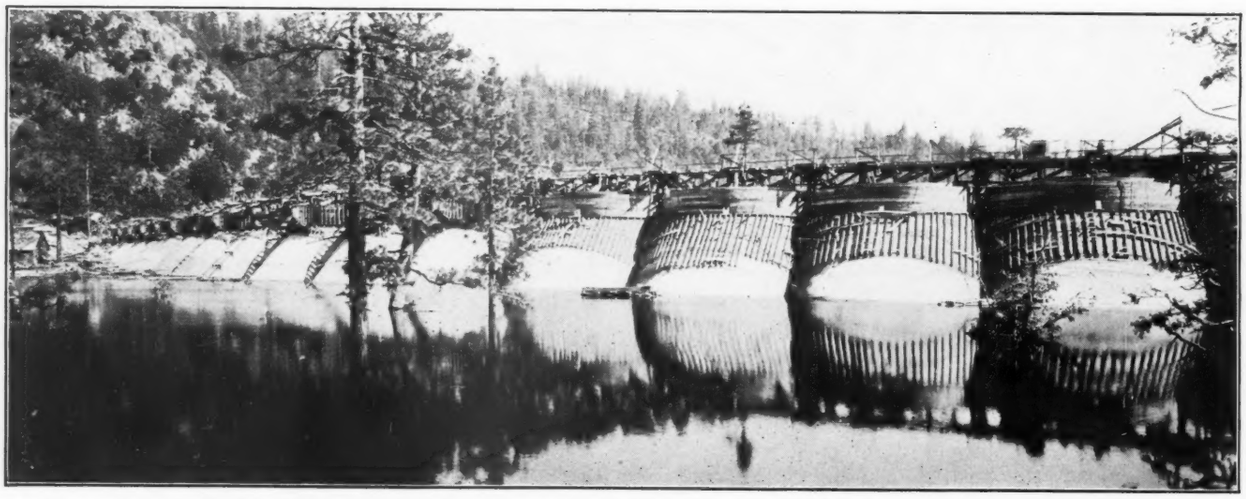
The greatest advantage of the loading machine is rapidity. The rate of progress depends largely upon the prompt removal of the broken rock from the face



Hetch Hetchy railroad, built especially for the aqueduct project



Rocking-loading plant at Big Creek. Shaft in the background



Eleanor dam, looking downstream

and is rated to operate efficiently through a maximum of 13,000 linear feet of 24-in. steel pipe. A 25-hp. Westinghouse motor drives the blower by means of an 8-in. rubber belt. One or two of these units is provided at each camp, according to the number of headings.

Pipe lines are so arranged that the machines may either blow or suck from the face, but sucking is used almost exclusively. The latter method, of course, has the advantage of keeping the adit clear for the benefit of motormen and others who may be engaged at miscellaneous work back from the face. The ventilating line is suspended by wire slings from short lengths of drill steel that are wedged into special holes drilled at intervals of 5 ft. in the side of the tunnel. The pipe is placed overhead and out of the way as much as possible. The free end of ventilating pipes is kept within 100 ft. of the face, and fumes can be cleared from the heading in from twenty to thirty minutes after the blasting of a full round. This last statement must be qualified by explaining that a "booster" blower has been installed at a point in the Priest adit 9,500 ft. from the portal. This is a No. 3 Roots horizontal machine operating at 3-lb. pressure, and obtaining its power from a Troy vertical air engine. This blower is simply "inserted" in the main ventilating pipe line. It should be remarked that the line at this point is composed of wood-stave pipe, 14 in. inside diameter, made of fir, and banded spirally with ¼-in. galvanized-steel wire. The outside is coated with a mixture of asphaltic bitumen sufficiently thick to cover completely and protect the wire. The pipes are 10 to 16 ft. long, and unions are made by driving the slightly tapered end into a redwood sleeve or collar. The pipe is supplied by the Pacific Tank & Pipe Co.

Two Kinds of Ventilating Pipe Used

This type of ventilating pipe is now used in all the work that is under the supervision of Dennis & Wilson, although at the start the headings were equipped with 24-in. steel pipe, and in all but Priest Portal and Big Creek this is being used for current extensions. This pipe comes in 19½-ft. lengths; it is made of No. 16 U. S. gage sheet steel and is dipped in a tar paint to give it a protective coating. Unions are made by means of a steel collar that is tightened by tension bolts; a sheet of tarred paper is used beneath the collar. A newly made union is air-tight, but after being subjected to blows and sundry strains it is likely to become leaky; and, when once a leak develops, it is generally difficult to stop it. Another objection to the steel pipe is that it unavoidably becomes dented; dents produce eddies in the air current, and increase the resistance to the passage of the fume and bad air. It is clear that a new 24-in. pipe with tight joints would have many times the capacity of a 14-in. pipe under the same pressure. Just how much this advantage is offset by the greater liability to leakage and to denting is difficult to determine because of sundry inherent obstacles to making a comparative test.

Machine vs. Hand Shoveling

The broken rock from a 12-ft. round in the larger tunnel, assuming an overbreak of 15 per cent, would be about 180 tons (I give tons instead of cubic yards because it means more to the mining engineer); and from an 8-ft. round in the smaller tunnel it would be about ninety-five tons. Manifestly, the shoveling of this material into cars is one of the problems that demand careful study. Six good experienced shovelers can load ninety-five tons in an eight-hour shift. They work in groups of three, the groups alternating in filling their cars; each man shovels half of the time and rests half of the time, except for the brief period required for changing cars. Each group pushes in its own empty car and pushes out the loaded one to await the motor.

As a matter of fact, experience at Hetch Hetchy has shown that the cost per cubic yard of material loaded is less when done by hand than when done by machine. However, two factors favor the machine. One is that it is much faster: where rapidity of progress is essential, shoveling by hand cannot compete successfully with the mechanical shovel. The second is that the machine obviates the need for finding capable men to do the shoveling, and the work cannot be delayed for a shift because a crowd of shovelers decide, without warning, to "draw their time." The Hetch Hetchy work was started in 1918, when it was particularly difficult to get men for hard work, and that fact made the adoption of mechanical shoveling the only possible course.

Two kinds of shovels are used: the No. 4 Myers-Whaley machine is standard for all the adit headings, and the Hoar underground shovel is used in the headings that start from the Big Creek shaft, and will probably be used when the lateral work begins at Second Garrotte. The reason for using the Hoar machine is the fact that it is smaller; it has lighter parts, and can be lowered conveniently through the shaft. This should not be construed to mean that the Hoar is not giving satisfaction; but, if it had been practicable, the use of the same machine in all of the headings would have been preferable. Economy would have been effected, for instance, in obviating the need for carrying in stock an additional supply of repair parts, and for training operators for an additional type of machine.

Hoar and Myers-Whaley Mechanical Shovelers

I shall not attempt to describe the two machines, but will draw attention to (a) some of the important features of the operation of each, (b) some of the lessons learned as a result of the use of the machines at Hetch Hetchy, and (c) some figures on the cost of maintaining the Myers-Whaley machine.

The Hoar shovel operates in much the same manner as the ordinary steam shovel, except that it has been designed primarily to allow it to operate in extremely close quarters. It is operated by three remarkably compact and efficient compressed-air engines. The dipper-stick arm is supplemented with an extension-arm that permits the machine to function properly in a restricted space; when the dipper has been loaded the dipper-stick, the arm, and the extension "contract" and lie parallel to each other above the frame. In this position the body of the shovel revolves 180 deg. on the truck, and the dipper is thrust forward over the car that is being filled. The hinged bottom swings away, as in the ordinary steam shovel, to dump. The working parts are inclosed in a steel housing that protects them from rock and grit; there are no particularly delicate parts, and the construction seems to be rugged throughout. The machine weighs, complete, 5,400 lb.

The Myers-Whaley shoveler is a more elaborate machine. It weighs 18,500 lb., or more than three times as much as the Hoar shovel. It is operated by means of a 20-hp. electric motor. The shovel proper and a short belt conveyor are mounted on a large swinging

jib, the movement of which permits operation at any point in an arc covering the face of the drift. The shovel empties onto the first conveyor belt, and it in turn discharges onto a second and longer belt that is mounted on the main frame, from which the jib swings. The whole machine is self-propelling and can be moved forward into, and backward from, the pile of rock as each shovelful is taken. This machine is more complicated and more delicate than the Hoar, but it has a much larger capacity; it can load easily four tons of rock in three minutes, and as it propels itself no time is consumed in advancing the machine and clamping it to the track. Sectional lengths of track, of course, must be laid at intervals as the edge of the rock pile retreats toward the face.

Experience at Hetch Hetchy has shown that an extra machine is essential. At Priest Portal and at Early Intake two machines, and at the two-heading camps three machines, are provided, thereby permitting one machine to be in the repair shop all the time. A first-class mechanic at each camp makes it his sole business to keep the shovels in repair. This is the only way to avoid costly delays. Obviously, an initial investment of $20,000, the approximate cost of two Myers-Whaley machines, would be warranted only by a large project. Interest, capital expenditure, and charges for depreciation must be considered in calculating the cost of loading as compared with shoveling by hand.

Heavy Wear Involves High Maintenance Cost

The most serious source of trouble with the Myers-Whaley machines has been the rapid wear of belt conveyors. These consist of any 30-in. rubber or fabric belt, on one or both sides of which are bolted, at intervals of ¾ in., narrow steel channel bars as a protective armor. On each side endless roller chains propelled by sprocket wheels serve to keep the belts in motion. A change that has been made in the construction of these belts has served to lengthen their life greatly. For the roller chain has been substituted a special chain made of manganese steel, the links of which are designed so that the wearing surface is broad and also protected. This prevents the chain from "stretching," as the result of rapid wear, and the consequent breaking of the fabric belt upon which the strain necessarily falls if the chain becomes too long.

At best, one might expect high maintenance cost for a complicated machine subjected to the severe service, not only of handling hard heavy rock in pieces varying in size from gravel up to three feet or more, but also of withstanding the abuse that is inseparable from underground work. The figures in Table III apply to the Myers-Whaley machine:

TABLE III. MAINTENANCE COST. MYERS-WHALEY SHOVELING MACHINES.

Camp	Period, Months	Cost per Foot of Advance: Labor	Material	Total	Cost per Ton of Rock, Total
Early Intake	11	$1.07	$2.94	$4.01	$0.21
South Fork	9	.31	.74	1.05	.055
Adit 5-6	5	.63	1.66	2.29	.12
Priest Portal	11	.86	2.41	3.27	.26

It should be noted that the machines at Priest Portal and at Early Intake were older than the others, which accounts in part for the wide variation. However, the smaller figures should not be taken as representative of what may be expected in average work.

One of the important requirements for rapid progress with the shoveling machine is an effective arrangement for disposing of the loaded car and replacing it quickly with an empty one; this necessitates a switch within a reasonable distance of the face. A simple but serviceable portable switch and siding, of sufficient length to accommodate eight cars, has been devised to facilitate this work. For the main track 30-lb. rails are used, whereas the siding and switch are constructed of 16-lb. rails, so that they are less cumbersome to move ahead. No frogs are required, the outer rail of the switch being hinged at a point where the "cross-over" starts, in such a manner that the lighter track may be swung horizontally until the free end rests on top of the main track. The light rails are tapered vertically to make a smooth junction. The 16-lb. rails are bolted to flat steel ties made of ⅜ x 3-in. material, and spaced 4 ft. center to center. The whole arrangement may be moved ahead bodily, thereby providing storage room, within 50 ft. of the face, for empty cars; moreover, there are no periodic delays to traffic for putting in place the usual frogs. The side track is used for empty cars only, the main line being reserved for the loaded cars and the motors.

Storage-Battery Locomotives Used for Tramming

Electric storage-battery locomotives are employed for tramming the rock. At first thought it may seem that the trolley locomotive would be preferable, for the reason that it is particularly efficient for long, straight hauls where a large quantity of rock must be moved and high train speed is desirable. The back of the tunnel is high, and the trolley wire would not be a serious source of danger; the rock is solid, so that the maintenance cost of the trolley line in the completed portion of the tunnel would not be excessive. The one consideration that favors the storage-battery locomotive is the rapid advance made in the heading. If a trolley wire were required, electricians necessarily would be engaged every few days in extending it. This would entail some delay and inconvenience to drilling and in shovel operations; moreover, the actual work of placing timbers to carry the insulators and of stringing the wires would be an item of additional expense. Accordingly, the selection of storage-battery haulage was unquestionably justified. The locomotives are all made by the General Electric Co., and are provided with eighty Edison cells having a capacity of 225 amp.-hr. At Early Intake and at South Fork two five-ton and one four-ton, and at Adit 5-6 three five-ton machines, are used.

At the other camps, each locomotive weighs about four tons and can exert a pull of 1,600 lb. before the wheels slip. They are equipped with two motors, one geared to each axle. Three locomotives are provided at the two-heading camps, thereby permitting at least one to be "charging" at all times. The charging equipment consists of a 25-kw. motor-generator set, made by the General Electric Co., at each of the camps where the large tunnel is being driven, whereas similar units of 15-kw. capacity are used at the others.

Care is taken to see that no one operates or charges the locomotives that has not first been given complete instruction from the person authorized to teach operators. The motormen are well paid; they like the work and take an interest in keeping their machines in first-class condition. Another factor that promotes efficient haulage is the care of the track. I may say that I rode into five different headings, and I was impressed with the comparative freedom from bouncing and lurching; which speaks well for the roadbed.

Two kinds of cars are used to carry the rock. A standard all-steel Mattison ore car made by the Joshua Hendy Iron Works, of San Francisco, is used in the smaller heading. This car has a capacity of about 54 cu.ft. and is arranged to dump on the side. In the larger heading a car of approximately 81 cu.ft. capacity, designed by the Construction Company of North America, is standard. The running gear is furnished by the Western Wheeled Scraper Co., of Aurora, Ill., but the body is made in the shops at Groveland from lumber cut at the city's sawmill. Band iron and rod iron are used to reinforce the wooden structure, and it is lined with ¼-in. boiler plate; a strong, durable car is the result. The running gear costs $275 delivered at the tunnel, and the body, complete, costs $250. The purpose sought in building the cars at the local shops is to take advantage of the availability of low-cost lumber on which no freight of any consequence has to be paid. The use of these cars has reduced materially the cost of tramming.

Progress in Driving the Tunnel

The profile sketch (see map) shows the elevations of the principal points, the distances between headings, and the progress that had been made up to Jan. 1, 1922. Since the meandering of the course of the aqueduct is not indicated, the sketch shows the actual distance to be driven, not the projection upon a vertical plane. The darkened portions of the tunnel indicate the part completed on Jan. 1. The long space between Big Creek west heading and the Priest heading shows at a glance why it is advisable to complete the Second Garrotte shaft. Even if only one or two thousand feet be driven in each direction, it will be worth while, for the reason that the time of completion of the entire project depends upon the progress made in this segment of the tunnel. Another feature is that the western part must be lined with concrete, whereas that to the east virtually will be finished when the excavation is completed. It is the intention to stop tunnel driving when the placing of concrete begins in a particular heading, on the theory that neither operation can be performed efficiently if the attempt is made to do both simultaneously through the same adit or shaft. Accordingly, it is planned to discontinue tunneling in Priest Portal soon after lateral work is started from the Second Garrotte shaft, which should be toward the end of this year. That will give an opportunity to make an early start on the longest segment of concrete work—namely, that starting from Priest Portal.

TABLE IV. SCHEDULE OF WORK

	Average Daily Progress in October, 1921, Feet	Estimated Future Daily Progress, Feet	Drill Rounds in October, 1921	Average Progress per Drill Round, Feet	Daily Schedule of Operation
Early Intake	10.2	11.0	31	10.2	1 drill shift, clean set-up
South Fork E.	11.8	12.0	31	11.8	Call shifts, clean set-up
South Fork W.	12.4	13.0	32	12.0	Call shifts, c'ean set-up
Adit 5-6 E.	13.1	12.0	36	11.3	2 drill shifts
Adit 5-6 W.	14.2	16.0	47	9.4	3 drill shifts
Adit 8-9 E.	14.7	16.0	68	6.7	3 drill shifts
Adit 8-9 W.	16.0 (a)	16.0	25	6.5	3 drill shifts
Big Creek E.	13.8	13.0	62	6.9	2 drill shifts
Big Creek W.	13.4	15.0	62	6.7	2 drill shifts
Priest Portal	22.1	24.0	95	7.2	3 drill shifts

(a) For days actually worked.

Systematizing Operations

The profile sketch will throw light upon the data in Table IV, which indicates the schedule of operations in the different headings.

Some comment and explanation of these data may be desirable. At Early Intake, where there is no particular need for rapid progress, it has been found most economical to work two regular shifts and one "clean-up" shift. The tramming is done on the day shift, the drilling and blasting on the evening shift, and miscellaneous work on the night or "grave-yard" shift. Only four or five men work at night, their duty being to clean up back of the face, lay new track, extend air and ventilating lines, repair old track, and otherwise prepare for the day shift, so that nothing will delay the loading, which must proceed with dispatch if it is to be completed within the eight-hour period. With a clean set-up, two bars, each carrying three drilling machines, are operated simultaneously. Here again continuous work without serious interruption is necessary if the round is to be finished and fired during the shift. The drilling of forty-eight holes from 13 to 16 ft. deep in tough monolithic granite cannot be accomplished unless it be performed under advantageous conditions.

Under the "call-shift" plan established at South Fork, the shifts, instead of beginning at regular hours, follow in sequence, the drillers being "called" so as to start as soon as the heading is clear. As a result, the rate of one round per day is bettered; small gains accumulate whereby a few extra rounds are fired each month. Some might be inclined to question the wisdom of disarranging an established daily program, but in isolated camps where there is nothing but the "job" to occupy the men, this factor probably is not important.

In all of the remaining headings it is usually necessary to start the drill round before the rock from the previous blast has been cleared from the face. Drilling and shoveling are performed simultaneously, the primary reason, of course, being the desire for rapid progress. The necessity for hoisting at Big Creek imposes some restriction on the speed, and it has been found more efficient to work on a schedule of only two drill shifts. The distance to be covered in Adit 5-6 East is short, and only two shifts are worked.

Table V shows the total operating cost per foot of tunnel driven in the various headings. Table VI shows the detailed cost at Adit 5-6 during the month of October, 1921, and Table VII shows the same data for

TABLE V. ACTUAL OPERATING COST PER FOOT OF ADVANCE

	Intake		South Fork		Adit 5-6		Big Creek		Priest	
	Labor	Material	Labor	Material	Labor	Material	Labor	Material	Labor	Material
December	.....	.....	.....	.....	.....	.....	$30.04	$29.40	$18.69	$18.98
November	$32.50	$32.30	$30.50	$32.60	$23.97	$27.42	25.06	21.12	18.85	23.42
October	30.90	34.00	28.00	24.72	24.33	24.61	25.65	23.20	18.77	20.00
September	30.50	41.43	30.50	23.01	24.28	23.12	25.93	24.62	19.51	19.33
August	36.00	33.00	32.40	24.71	25.04	29.80	26.89	22.85	17.88	15.70
July	44.00	33.50	34.50	24.66	21.22	29.69	27.52	19.29	19.75	19.67
June	34.51	31.86	32.50	26.00	22.94	21.67	28.96	23.93	20.40	19.63
May	.....	.....	29.40	28.40	.....	.....	25.00	26.00	21.05	16.64
April	.....	.....	31.25	30.16	.....	.....	33.00	24.00	24.68	23.92
Average	$34.74	$34.35	$31.13	$26.78	$23.63	$26.05	$27.56	$23.82	$19.95	$19.70
Combined labor and material	$69.09		$57.91		$49.68		$51.38		$39.65	

Priest Portal. These are selected as being typical for work in headings of each size. In explanation of the items "3-per cent camp" and "2-per cent plant," it should be stated that the contract with the Construction Company of North America provides that the city shall erect the necessary quarters, boarding houses and other requisites at the camps, and that a charge of 3 per cent per month shall be made against the contractor to provide for the depreciation. Machinery and other permanent equipment is purchased by the city under the same conditions, except that the charge is fixed at only 2 per cent per month on the theory that the salvage value of the machinery when the construction is concluded will be greater than that of camp equipment.

TABLE VI. ADIT 5-6—SUMMARY OF COSTS FOR OCTOBER, 1921

Progress: E. 406 ft.; W. 440 ft.; Total, 846 ft.

Labor	Excavation	Shoveling Machine	3 Per Cent Camp	2 Per Cent Plant	General	Total
Tunnel foreman	$307.80	.....	.....	.....	.....	$307.80
Asst. foreman	245.30	.....	.....	.....	.....	245.30
Camp foreman	.....	.....	.....	.....	$149.80	149.80
Time clerk	.....	.....	.....	.....	138.56	138.56
Shift boss	1,046.60	.....	.....	.....	.....	1,046.60
Head mechanic	.....	$256.80	.....	.....	.....	256.80
Mechanic helpers	256.95	$408.55	.....	$35.00	.....	700.50
Laborer	158.25	.....	$1.30	.....	.....	159.55
Tool sharpener	601.05	.....	.....	.....	.....	601.05
Helper	311.10	.....	.....	.....	.....	311.10
Blacksmith	295.40	.....	.....	112.50	.....	407.90
Helper	397.10	.....	.....	.....	.....	397.10
Machine man	2,932.90	.....	.....	.....	.....	2,932.90
Chuck men	3,518.05	.....	.....	.....	.....	3,518.05
Track man	406.45	.....	.....	.....	.....	406.45
Truck driver	229.90	.....	80.40	33.85	.....	344.15
Shovel machine-men	1,149.65	.....	.....	.....	.....	1,149.65
Motorman	1,038.60	.....	.....	.....	.....	1,038.60
Shovelers	4,896.75	.....	.....	36.25	.....	4,933.00
Compressor men	347.20	.....	.....	.....	.....	347.20
Electricians	331.25	.....	.....	.....	.....	331.25
Line men	185.00	.....	.....	.....	.....	185.00
Labor, Groveland shop	72.80	.....	.....	420.10	.....	492.90
Powder men	172.95	.....	.....	.....	.....	172.95
Dump men	51.00	.....	.....	.....	.....	51.00
	$18,952.05	$665.35	$81.70	$637.70	$288.36	$20,626.16
Labor, excavation, shoveling-machine repairs, and general				.....		$19,906.65
Plant, this report				$637.70		
Forwarded from September				3,955.00		
			2 per cent of	$4,592.70	is	91.65
Camp, this report				81.70		
Forwarded from September				19,400.39		
			3 per cent of	$19,482.09	is	584.46
Total				.....		$20,582.76

Unit Cost for Labor, $24.38

Material	Cost f.o.b. Groveland	Freight to Buck Meadows	Total	Unit Cost
Powder, caps, fuse	$7,972.19	$24.90	$7,997.09	$9.45
Oil and grease	237.91	13.82	251.73	0.30
Miscellaneous material	7,019.22	169.94	7,189.16	8.50
Shoveling-machine repairs	1,067.64	5.64	1,073.28	1.27
Drill repairs	821.32	3.60	824.92	0.98
Power and lights	1,097.97	.....	1,097.97	1.30
Camp 3 per cent	552.77	.....	552.77	0.65
Plant, 2 per cent	1,836.10	.....	1,836.10	2.16
Total	$20,605.12	$217.90	$20,823.02	$24.61
Unit cost for material				$24.61
Unit cost for labor				24.38
Total cost per foot				$48.99

In connection with the figures on labor cost, the scale of wages is interesting. The rates that prevailed during the period covered by the figures of cost are shown in Table VIII.

At the time when preparations were being made to start the tunnel aqueduct, proposals for doing the work by "straight" contract were invited. The estimate of the City Engineer as to the reasonable cost of the work was $65 per linear foot. The lowest bid submitted was $95 per foot, and all bids accordingly were rejected. As has been stated, the original plan provided for the lining of the entire tunnel with concrete, and the estimates and bids were calculated on this basis. It is estimated that the concreting will cost not more than $20 per foot, so that the actual operating cost of the lined portion will be about $60 per linear foot, whereas that of the unlined portion will probably average less than that. This does not include the profit of the contractor, the cost of engineering, and miscellaneous overhead expense, but it is probable that the estimates of the City Engineer will not be exceeded. It is true that the cost of supplies is less than it was when the work was started, that wages are lower, and that workmen are more efficient; nevertheless, a saving of nearly $3,000,000 will be effected over the expenditure that would have resulted had the lowest bid in 1918 been accepted.

TABLE VII. PRIEST PORTAL—SUMMARY OF COSTS FOR OCTOBER, 1921 (*a*)

Progress, 686 ft.

Labor	Excavation	Shoveling Machine	General	Total
Sub-contractor	.....	.....	$185.70	$185.70
Assistant superintendent	.....	.....	111.25	111.25
Tunnel foreman	$319.40	.....	.....	319.40
Camp foreman	.....	.....	95.00	95.00
Shift boss	836.75	.....	.....	836.75
Machine men	2,391.35	.....	.....	2,391.35
Chuck men	1,445.80	.....	.....	1,445.80
Shovelers	2,287.60	.....	.....	2,287.60
Shovel-machine men	706.25	.....	.....	706.25
Motor men	1,259.45	.....	.....	1,259.45
Dump men	312.05	.....	.....	312.05
Tool sharpeners	435.20	.....	.....	435.20
Helpers	541.65	.....	.....	541.65
Head mechanic	.....	$289.10	.....	289.10
Mechanic helpers	132.90	280.30	.....	413.20
Compressor men	548.70	.....	.....	548.70
Electricians	298.60	.....	.....	298.60
Truck men	190.45	.....	.....	190.45
Laborer	17.50	.....	.....	17.50
Line men	5.70	.....	.....	5.70
Labor, Groveland shop	135.35	.....	.....	135.35
	$11,864.80	$569.40	$391.95	$12,826.15
Labor, excavation, shoveling-machine repairs, and general				$12,826.1
Plant, this report		0.00		
Forwarded from September		$528.65		
2 per cent of		$528.65 is		10.57
Camp, this report		0.00		
Forwarded from September		$233.07		
3 per cent of		$233.07 is		6.99
Total				$12,843.71

(*a*) There were no costs for 3 per cent camp and 2 per cent plant at Priest Portal during this month.

Unit cost for labor—$18.77.

Material	Cost f.o.b. Groveland	Freight to Priest	Total	Unit Cost
Powder, caps, fuse	$4,328.51	$0.61	$4,329.12	$6.31
Oils and greases	273.64	2.50	276.14	.40
Miscellaneous material	5,289.55	67.95	5,357.50	7.81
Power and lights	1,030.25	.....	1,030.25	1.51
Shoveling-machine repairs	1,334.52	.50	1,335.02	1.95
Drill repairs	984.06	.50	984.56	1.43
Plant, 2 per cent	374.52	.....	374.52	.55
Camp, 3 per cent	26.00	.....	26.00	.04
Totals	$13,641.05	$72.06	$13,713.11	$20.00
Unit cost for material				$20.00
Unit cost for labor				18.77
Total cost per foot				$38.77

TABLE VIII. WAGES PER EIGHT-HOUR SHIFT

Shift bosses	$7.00	Blacksmiths	$6.25
Drill runners	5.50	Powder men	5.00
Chuck men	5.00	Compressor men	5.25
Shovelers	4.25	Electricians	7.75
Shovel-machine operators	6.00	Hoist men	8.00
Motormen	5.50	Track foremen	5.50
Tool sharpeners	6.25	Storekeeper and timekeeper, per month	175.00
Tool sharpener helpers	5.00		
Head mechanic	7.00	Tunnel foreman, per month	287.50
Mechanic helpers	5.50		

Work Accelerated by Bonus

A monthly bonus system, in which all the men at a particular heading participate, is based on the progress made in excess of a predetermined standard. At Priest Portal during the month of August the bonus amounted to about $60 per man, but that is of course unusual. This plan serves as an incentive for hard work and promotes good-will among the employees. Hard work alone will not establish records for tunnel driving; there must be efficient organization. Each detail of operations must be carefully scheduled and systematized; there must be intelligent direction and general co-operation.

Marketing of Barytes

Mining of the Mineral Has Increased Greatly During Last Five Years—Georgia and Missouri Are the Principal Domestic Sources—Manufacture of Lithopone, an "Infant Industry," Takes Half the Output—Used in Rubber and Paint

By S. W. Thompson
President, Thompson, Weinman & Co., New York

THE ORE called barytes contains essentially the mineral barite; it is found in various forms of deposits in about twenty states in the United States and in Alaska, which, according to the size of the deposits, rank about as follows: Missouri, Georgia, Tennessee, Alabama, California, North Carolina, Virginia, South Carolina, Wisconsin, Nevada, New Mexico, Idaho, Illinois, and Alaska.

Under present conditions there are only about eleven states in which barytes mining is carried on to an important extent. Many of the other states in which the deposits occur are so far from the consuming points that railroad freight rates are prohibitive for the present. A market for barytes is assured; therefore, the mining and preparation of the crude ore is rapidly becoming a large industry, one county in Georgia having investments in mining and milling property and plants totaling over $1,500,000.

Used in Manufacturing Lithopone and Various Other Products

Crude barytes, after washing and grinding, is used as an inert pigment and filler by paint and rubber manufacturers, and it is also used in the production of lithopone and various chemicals. The most common chemicals other than lithopone derived from barytes are as follows:

Barium binoxide, which is used in the distillation of peroxide of hydrogen.

Barium carbonate, which is used by pressed brick manufacturers to neutralize the sulphur content, and also by rubber manufacturers for the same purpose.

Barium chloride, which is used as a mordant by dry color manufacturers, and in the tanning of leather. It is also used in the manufacture of battery plates.

Barium nitrate, which is used in the manufacture of munitions and in making "red fire" material.

Barium sulphate precipitated, (blanc fixe), which is largely used by rubber manufacturers. It is also used for interior painting of battleships and on all steel interiors of sea-going vessels. It is used as a detector in taking interior X-ray pictures of the human body.

By far the largest tonnage of barytes is used in the manufacture of lithopone, as from a total of 175,000 tons produced in 1921 about 90,000 tons, or over half, was used by the manufacturers of this material, the remainder being divided between the ground barytes—which is sold as a pigment—and the barium chemicals. Lithopone is an artificially prepared compound composed of 70 per cent barium sulphate and 30 per cent zinc sulphide, precipitated together. It is a recognized standard pigment and filler used by paint and rubber manufacturers and today the normal amount manufactured in the United States is above 130,000 tons, which at the recent price of 7c. a pound represents a total of $18,200,000 for an "infant" industry. About 80 per cent of the lithopone is manufactured in Pennsylvania, New Jersey, Delaware, and Maryland, and the remaining 20 per cent in the states of Illinois, Missouri, and California.

The distribution points of the raw material for consumption at the plants of the lithopone and barium chemical manufacturers would be Chicago, St. Louis, and the large cities in the east central states. The lithopone industry, according to the above figures, has assumed large proportions since 1915, due largely to the increased use by both the paint and rubber manufacturers and to the fact that during the war no imports of either raw material or finished products came into the United States. For instance, in 1880, 21,000 tons of crude barytes was produced and sold in the United States; in 1915, 108,547 tons was produced; in 1920, 228,113 tons was produced and about 24,000 tons was imported from Germany, making a total of 252,113 tons consumed in the United States during 1920. About 49 per cent of the barytes used in 1920 was made into lithopone, about 35 per cent was ground and refined, and 16 per cent was used in the manufacture of barium chemicals other than lithopone.

In preparing the crude mineral for the market certain specifications regarding its barium content must be met. The thorough washing and separation of foreign material from the ore is necessary, and equipment is installed at the mines where it is produced in marketable quantities to do this "concentrating." The chemical composition of barite (barium sulphate-natural) is $BaSO_4$.

Value of Ore Varies With Barium Content—100-Ton Plant Costs $75,000

The higher the barium content the greater is the value of the ore, and for all purposes this is the essential element required. Mineral impurities of various kinds should be removed from the ore before shipment. Processes, such as washing in revolving screens and in log washers, are followed by passing the ore over picking belts and through jigs. The modern barytes washing plant has been developed as a result of experience, augmented by the application of mining engineering knowledge of the equipment. A plant equipped to produce one hundred tons of washed barytes per day costs about $75,000.

There is no regularity as to the size or shape of the particles of crude ore, as in some deposits it occurs in solid veins and, when blasted during the operation of mining, scatters into various sized particles, which are shipped as taken from the mine. In other deposits, such as those found in the states of Georgia, Missouri, Tennessee, and Alabama, the barytes occurs mixed with residual clays and is mined and loaded by steam shovels on to cars which carry it to the washers. The size of the particles in these deposits varies from sand up to pieces containing as much as two cubic feet.

The practice has been dropped of allowing a premium or exacting a penalty based on the grade of the ore.

It is now shipped on its merits, and the producer is recognized as responsible, as he can easily maintain an average barium sulphate content above 90 per cent in the marketed product.

The quantities of crude barytes produced and sold on contract for a year's supply run as high as 20,000 tons to a single purchaser, depending upon the consuming power of the manufacturing plant. The contract price is fixed in advance to cover the entire quantity and the material is shipped in equal monthly consignments. Crude ore is shipped in bulk in box cars, the cars containing approximately thirty tons.

The method of sampling varies at the different plants. Some take a four-inch pipe and drive it from the top of the pile in the car to the bottom of the ore, and repeat this in four places in the car; this gives them a fair sample. Again, the manufacturer may throw a shovelful aside from each ton of ore removed from the car; this sample lot is thoroughly mixed, forming a composite sample, and the laboratory test is made therefrom. The ore is sold on shippers' weights, and no allowances are now made for moisture, which never exceeds 1.4 per cent when received at the plant to which it is shipped. There is no necessity for carrying insurance on the ore for its protection while it is in transit.

The value of the ore up to the present time has been regulated largely by the import price, and has never been high enough to afford an excessive profit to the producer. Crude barytes is sold by the long ton of 2,240 pounds, except in the Missouri district, where the short ton is used. The terms are net cash.

The demand for barytes has increased materially of late years, as the figures given below indicate. I see no reason why it will not continue to increase, as the manufacture of lithopone is now standardized so far as color and chemical analysis go. Statistics of crude barytes produced and marketed in the United States from 1880 to 1920, together with the average price during recent years, are shown in the accompanying table.

CONSUMPTION OF CRUDE BARYTES IN THE UNITED STATES

Period		Quantity, Short Tons	Average Value Per Ton
Ten years	1880–1889	21,410 (*a*)	(*b*)
Ten years	1890–1899	27,523 (*a*)	(*b*)
Ten years	1900–1909	58,310 (*a*)	(*b*)
Five years	1910–1914	43,389 (*a*)	(*b*)
Year	1915	108,547	(*b*)
	1916	221,952	(*b*)
	1917	206,888	$5.66
	1918	155,368	6.73
	1919	209,330	8.20
	1920	228,113	9.08

(*a*) Annual average for the period; (*b*) No data.

The above figures are compiled by the Government, and show a rapid growth of the barytes mining industry in this country. All the various products made from barytes are consumed in the United States. The influence of imported ore on the domestic market is always threatening, as the foreign cost of production is on an average about half the American cost. Recent quotations in New York give the current prices as $9 per ton f.o.b. mines for crude barytes; ground white, $23 f.o.b. mills; off-color grades, $16 to $21 f.o.b. southern mills. If allowed the present duty which Congress has formulated, the industry should be able to survive; but without the protection which the new tariff provides it will cease to exist.

The Greatest Zinc Mine in Central Europe

BY E. P. RATHBONE

What is known as the Giesche's Erben Zinc Mining Co., which is operating in Upper Silesia, has unquestionably the most productive zinc property in Central Europe. While engaged on work connected with the British Commission of the Plebescite between Germans and Poles in Upper Silesia I was afforded an exceptional opportunity of visiting the company's ore-dressing plant.

In the eighteenth century George Giesche, a merchant of Breslau, became interested in the property, and the zinc produced was largely used in making utensils. The zinc production in 1816 was only 20,000 centners[1] but by 1825 had increased to 250,000 centners and from 1840 on production rapidly advanced so that in 1850 it was 500,000 centners, in 1860, 800,000 centners and about fifty or sixty smelting works were employing 3,000 to 4,000 workmen, the production amounting to over 40 per cent of the whole world's output.

In 1878 Upper Silesia was producing 100,000 tons of zinc blende. In 1912 the mines produced 128,773 tons of carbonate of zinc ore and 393,290 tons of zinc blende. At present, in order to keep the large smelting works fully employed, a large quantity of foreign zinc ores is imported, principally from Austria and Australia. In 1911 the raw zinc production of Upper Silesia amounted to 63 per cent of the total amount of zinc used in Germany and was 17 per cent of the world's production. In 1912 the production of cadmium was 42,747 kg.

The price of zinc has soared greatly. A ton of raw zinc in 1811 was worth 1,125 German marks, whereas in 1830 it had fallen to an average of 150 marks. The manfacture of zinc sheets and zinc enamel ware raised the production in 1860 to 9,000 tons, and this had increased in 1912 to 52,250 tons of raw zinc. Large quantities of sulphuric acid were also manufactured, and in late years thirteen extra zinc roasting furnaces were erected. During the war, when extensive manufacture of explosives was being carried on, it is certain that had the Germans not owned this property and been unable to take those in Beligium at Vieux Montagnes, the war could not have been conducted, especially as the Australian supply was cut off from Germany.

The ore-dressing establishment is situated near Sharley. At the time of my visit the daily output was only 250 tons. The zinc ores contained on an average about 20 per cent of metal, and associated with the zinc there was a small amount of galena. The total extraction of all metal was over 88 per cent.

All machinery was electrically driven. The shaft was sunk 500 m. and the ore hoisted was loaded into iron wagons holding 10 cwt. After being automatically weighed the ore was screened, that which was over 100 mm. going to rolls to be further crushed to 45 mm., from there passing through a series of trommels which were in turn connected with Setz machinen or pulsator bed jigs classifying down to 1.5 mm. All slimes were treated on revolving and end percussion tables.

During the war these works turned out a large output of zinc daily, and in consequence the mines were too liberally worked. Sufficient development and prospecting work for new deposits was neglected.

About 500 men and women were empolyed at these works at the time of my visit.

[1]One centner equals 110.23 lb.

Manganese in India

Deposits in Several Districts Have Been Developed —Domestic Use Hinges on Improved Steel Metallurgy

By E. W. T. Slater

Before the war the greater part of the world's supply of manganese ore came from Russia and India, but, in the last few years, there have been discovered other sources in Brazil, on the Gold Coast of Africa, and in a few other places. Nevertheless, in spite of the competition of the new fields there is little doubt the manganese industry in the first two countries will continue to develop as the demand increases. The Indian fields have proved most useful, and the reports all go to show that the prospects for the future are good. The Indian ore, on account of its hard lumpy form, is much more suitable for blast furnaces than the more friable ores obtained from the Caucasus; and it is also possible, owing to the better selection, to export a product of more uniform quality than that which characterizes the Russian shipments.

The ore consists mainly of psilomelane with an important amount of braunite. The quality of the manganese varies in different fields in India, but on the whole the quality is considered high. The ores of the Vizagapatam district are mainly psilomelane with small amounts of pyrolusite and braunite; the typical ores of the central provinces consist of mixtures of braunite and psilomelane; the ores in Mysore are usually associated with banded ferruginous quartzites. The ores from the central provinces are considered to be of the highest grade while those from Vizagapatam and Mysore belong mainly to the second and third grades.

The ores of the first grade have a high manganese content, usually from 49 to 54 per cent and a moderately high iron—from 4 to 8 per cent. The silica varies from 6 to 9 per cent and the phosphorus from 0.07 to 0.14 per cent. The second and third grades are characterized by high iron and phosphorus contents and comparatively low silica.

Though a good deal of prospecting has been done there have been no new fields of considerable size discovered in other parts of India, though it is yet too early to say what a more complete survey will reveal. At present practically all the ore mined in India is shipped to Europe and America for conversion; only a few thousand tons are used in India, and this chiefly as a desulphurizer in iron and steel furnaces. With increased development of the iron and steel industry in India doubtless a larger demand will be made on the supplies, but for many years to come India necessarily will seek a market in the West. Unfortunately the high percentage of phosphorus in Indian iron ore and coke makes the supply not so satisfactory for Indian use as supplies from other parts. But with the improvements in the iron industry the necessary adjustments will probably be made.

The metallurgical uses of manganese are many but the greatest proportion, say 95 per cent, is used in the manufacture of iron and steel. The remainder is used in chemicals, for dry batteries, and in the glass and paint industries. It was estimated that in 1918 the demand for manganese for the manufacture of dry cells in America and flint glass was at the rate of 35,000 tons per annum. Unless new uses are discovered for the ore, it is not likely that the output of the Indian mines will greatly increase, but it is possible that the ore will be found increasingly useful for other purposes.

In a lecture delivered in Calcutta, L. H. Fermor, of the Geological Survey of India, stated that "of over 1,000 species of minerals known to science about one-eighth contain manganese as an essential constituent, and many others contain it in less important quantities. It is calculated that over 10 per cent of the earth's crust carries manganese peroxide, manganese being ranked as the fifteenth most important element in that respect. As a result of the decomposition and denudation of the surface of the earth, effected by rain and other agencies, its constituents are carried either in suspension or in solution to the sea, and it has been estimated that every year about 37,000,000 tons of manganese compound containing nearly 26,000,000 tons of manganese are carried in solution in river water to the sea."

Some years ago the manufacture of ferromanganese was begun in India in the works at Jamshedpur and the alloy produced was of the following composition: Manganese 70 per cent, phosphorus 0.55 per cent, and silicon 2 to 3 per cent. The output from one furnace reaches about 80 tons a day. Ferromanganese is also manufactured by the Bengal Iron & Steel Co., the product having a guaranteed minimum of 74 per cent manganese and a maximum of 0.55 per cent phosphorus. It is believed that, with a careful selection of the Indian ores, some real advance may be shown, though, as has been pointed out, new methods will need to be adopted in the blast furnace if India is ever to become eminent as a maker of ferromanganese. The possibilities of utilizing electric energy will have to be carefully considered.

Nitrate Situation in Chile Improved

The activity in the Chilean nitrate industry increased during June, and as a result the general economic situation in the country has improved, according to C. A. McQueen, the Commercial Attaché at Santiago. Exchange continues to rise, labor is being utilized, and there is a slight relief from the stringency surrounding the money situation, resulting from the continued liquidation of the stocks of nitrate on hand.

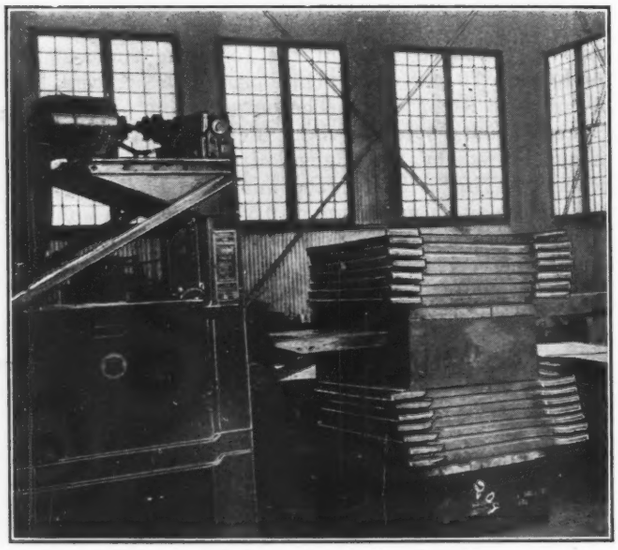
The lowering of nitrate prices has had the desired effect on sales, the Producers' Association having sold about 200,000 tons, largely for delivery during the first part of July. The exports of nitrate during the first five months of 1922 amounted to 250,000 tons. Sales which the association has booked, following the reduction in prices, promise a better movement during the second half of the year. Practically all of the nitrate purchases made, however, are for July delivery at the minimum prices fixed for the coming twelve months. The prices fixed for the busy season of the nitrate year (Dec. 1 to April 30) are about 1s. higher per Spanish quintal than those for delivery during the first half of July. Hope is felt that, with firmer cotton prices, the United States may absorb nitrate to such an extent as to tide over the situation until means are found to finance heavier consumption in Europe. The European stocks now amount to 220,000 tons, having been reduced from the 370,000 tons reported as held by the pool on April 1. The Chilean Government is expected to take a much greater part in trying to arrive at a solution of the country's difficulties than hitherto.

USEFUL OPERATING IDEAS

Handling Copper Products at Quincy Mining Co.'s Smelter

BY HENRY M. PAYNE

The finished product of the Quincy smelter, in northern Michigan, consists of 500-lb. anodes, 25-lb. ingots, 75-lb. ingots for brass, 200 to 500-lb. cakes for sheet copper, and 500-lb. cakes for wire bars. To handle these a 4,000-lb. Tier-lift storage battery truck



Piling anodes by Tier-lift truck at Quincy smelter, Michigan

has been installed. The various products are handled in tray loads, as shown in the accompanying photograph. These are stored in loads up to two tons per tray, to a height of 96 in., at a lifting speed of one foot in eighteen seconds. The truck cannot be operated unless the operator is in position with his foot on the pedal.

Before the installation of this equipment, it was necessary to place a four-wheel hand truck at the end of the conveyor, the separate articles being picked up by hand and weighed, taken to the warehouse and piled by hand. When time for shipment arrived, they were again loaded on a truck, hauled by tractor to the steamer wharf or railroad platform, and again handled.

Removal of a Bushing from a Blind Hole

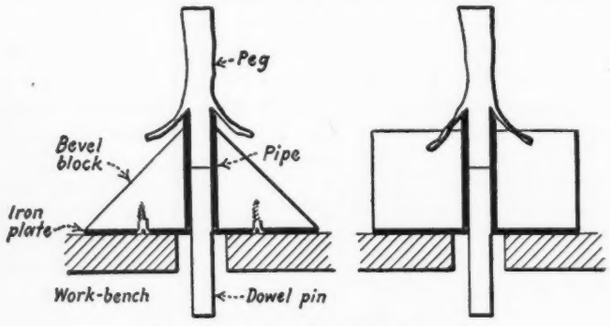
The removal of a brass bushing from a blind hole without damage is usually a troublesome proceeding. Ralph Wishon does it by simply filling the interior of the bushing with hard grease, inserting the shaft, which usually is a close fit, and striking the end of the shaft a sharp blow with a hammer. The grease is forced into the space below the edge of the bushing and lifts it up out of the hole.

A Device for Making Dowel Pins

BY C. N. SCHUETTE

At a certain isolated mine a supply of dowel pins was needed to dowel a quantity of wooden air pipe. To send out for them would have entailed a delay of two weeks Dowel pins about 4 in. long were required, and a device was constructed to make them. This may be described as follows:

A 3 in. length of pipe having an internal diameter equal to that desired of the dowels was filed square on one end and beveled toward the inside on the other. This pipe was set vertically, beveled end up, on an iron plate over a hole of the same diameter as the pipe. It was



Device for making dowel pins

held in this position by a beveled wooden block which was screwed to the iron plate in the manner shown in the drawing.

Old pick and shovel handles were sawed into 4 in. lengths and then split into roughly square pegs. These pegs were then driven through the pipe with a wooden mallet. By this method excellent dowel pins were made rapidly and at small cost.

Using Residue as Stope Filling

BY A. W. ALLEN

One of the advantages of the avoidance of sliming in chemico-metallurgical operations is seen in an ability to use at least a part of the residue as filling for depleted stopes. Thus, during 1921, the Crown Mines on the Witwatersrand returned 210,000 tons of sand residue to the underground workings. The material, which contains gold valued at about 30c. per ton, may possibly be treated again by percolation *in situ*, when oxidation has occurred, thus making a further extraction of gold possible.

In Western Australia, however, an all-slime residue is used successfully for such a purpose, but in this case the ore is roasted before cyanidation, then filtered in chamber presses. The roasting destroys the colloidal properties of the finer particles and the filter-press treatment results in the delivery of a residue that can be dumped in the same manner as can a coarser, granular product.

The recent proposal of the authorities at the Hollinger mine, if press reports are to be accepted as correct, will arouse interest in the question of using residue for stope filling. The process of ore treatment there is essentially an all-sliming one, but some of the more colloidal material is treated separately on Moore vacuum filters. The remainder of the pulp is impoverished of gold and cyanide by counter-current decantation; recently, Oliver filters have been added, it being maintained that the saving in cyanide alone would pay for the cost of operation of the filters. It is essential, of course, that tailing sent underground shall contain a minimum of cyanide, which may decompose into an exceedingly poisonous gas.

It seems probable that the plan will be to place the residue underground while wet, the expectation being that this will pack and drain when delivered into the old stopes.

The use of water as a medium for the delivery underground of filling material has been adopted extensively in coal mines, where reduction in fire hazard is an important consideration. In this case any available sand is used; it is flushed underground after having been mixed with sufficient water to permit easy transportation.

PRACTICAL INFORMATION

Explosives Used in Mining

Many commercial brands and kinds of explosives are in use and are graded according to strength by comparison on a weight-for-weight basis with straight nitroglycerine dynamites, which are the only explosives containing the actual percentage of nitroglycerine as designated. Other types make up their strength by use of nitro-substitution compounds, explosive salts, and guncotton. They are divided into three classes, which are: straight dynamite, ammonia or "extra" dynamite, and gelatin.

Straight dynamite consists of nitroglycerine, sodium nitrate, wood meal and antacid. The grades range from 15 to 60 per cent. They are suitable for use where strength and quickness are required and where water conditions are not too severe. The fumes given off are the worst of three classes. They are easily ignited by flame or spark.

Ammonia dynamites are made by replacing 50 per cent of the nitroglycerine with nitrate of ammonia. The grades range from 20 to 60 per cent. The fumes are much less obnoxious than those of straight dynamite. These dynamites are practically as good as gelatin. Their water-resisting qualities are not as good as those of straight dynamite, because of the solubility of the ammonium nitrate, but are considerably improved by coating the ammonium nitrate and dipping the cartridge in melted paraffin after filling. Ammonia dynamites are the most difficult of all the ordinary high explosives to ignite. They have a somewhat slower action than straight dynamite.

Gelatin dynamites are divided into gelatin dynamite and blasting gelatin. The first consists of blasting gelatin, sodium nitrate, and combustible material. Grades vary from 20 to 60 per cent. The second consists of nitroglycerine and guncotton. The grade of this is 100 per cent. The gelatin dynamites are distinguished by plasticity, high density, excellent water-resisting properties, and comparative freedom from obnoxious fumes. The action of gelatin dynamites is slower when detonated by a cap, but can be increased over that of corresponding grades of straight dynamite by detonating with a primer of very strong straight dynamite or blasting gelatin.

Granulated nitro-powder consists of sulphur, nitrate of soda, and high-grade blacksmith's coal, melted together and broken up to a size about the same as *FFF* blasting powder and coated with nitroglycerine. Powders of this description are known as Judson and low powder. The lowest grade is designated *R.R.P.* and contains 5 per cent nitroglycerine. The highest contains 20 per cent. *R.R.P.* should have a primer of 40-per cent or stronger dynamite in the proportion of 1 lb. of dynamite to 25 lb. of *R.R.P.* Those above 10 per cent in grade can be detonated with a blasting cap. This explosive is not recommended for underground work, on account of the nature of the fumes produced.

Low-freezing dynamites are made by incorporating nitro-substitution compounds, dissolved in nitroglycerine, in the mixture and by this procedure the freezing point of dynamites can be lowered. In general all that can be said of low-freezing dynamites is that they will not freeze until after water freezes and in addition to their low-freezing properties they are slow-freezing. That is, they will not become hard for from several days up to a month after the freezing point has been reached. Practically all grades of dynamite can be obtained in low-freezing brands.

Two classes of blasting powder are manufactured. *A* blasting powder contains potassium nitrate, charcoal and sulphur. *B* blasting powder contains nitrate of soda, charcoal, and sulphur. *B* powder is lower in cost than *A*, and therefore more generally used, as it is strong enough for most purposes for which blasting powder is used. Theoretically *B* should be slightly stronger than *A*, because of the higher oxygen content of nitrate of soda, which enables a higher percentage of combustible material to be used. Actual tests have demonstrated that *A* has a greater explosive effect than *B*. This is in contrast to the dynamites, in which the insoluble ingredients form a sufficient protection against the action of moisture to result in the "soda dope" dynamites havnig a greater explosive effect than those containing potassium nitrate. *A* powder is preferable for work in damp climates.

Blasting powder varies in strength, depending upon size of grains. The commonly used sizes of *A* powder are *E, F, FF,* and *FFF;* and of *B* powder *CCC, CC, C, F, FF, FFF, and FFFF*. The largest size, *CCC*, is approximately 1½ in. in diameter; *FFF*, the smallest, is ⅛ in. in diameter. Fine granulations are quickest in ignition. A special granulation of *B* powder for large blasts is called *R.R.* and consists of a mixture of *FF, F,* and *FFFF*. All grains are glazed with graphite, which offers a slight resistance to moisture and makes powder free running. Blasting powder is unaffected by cold but has little resistance to water.

Surface Arrangement for Hoisting

Headframes are constructed of steel or timber, the former being used on long-lived mines where first cost favors this material. The height of the headframe ranges from 40 to 185 ft. Deep shafts, in which rapid hoisting is to be done, require ample vertical height. Where hoisting is done at moderate speed, the height limitation is determined by the position of the landing platforms.

THE PETROLEUM INDUSTRY

Toteco-Cerro Azul Pool Produced 284,000 Bbl. of Crude on July 5

Whatever may be the productive life of the Toteco-Cerro Azul oil fields in Mexico, the end is not here yet. Production of crude oil in the pool on July 5 was 284,000 bbl. The Mexican Petroleum Co. produced about 113,600 bbl; Mexican Gulf, 85,200, and Mexican Seaboard, 85,200. The production was from wells in Toteco proper and those of the first named company on the border of the pool, according to the *World.*

E. C. Van Dyke, oil expert for Knauth, Nachod & Kuhne, international bankers, recently said that the history of Mexican oil pools and their inevitable invasion by salt water gave assurance that the Toteco-Cerro Azul pool could yet be expected to produce many millions of barrels of oil. He said the producing area, 3.5 square miles, was the largest ever developed in one pool in Mexico, while its actual limits had not been found because of the cessation of drilling, under the agreement of companies operating there to conserve the supply.

It was not unreasonable to expect, therefore, that a great area above the level of the deepest wells, which alone have been affected by the salt water, remained to be skimmed, which is the reduction of the normal flow of shallower wells to create a back pressure and keep the water and oil separated. Conditions can be determined by practical tests with the wells unaffected by salt water, and these will decide for the companies what volume of oil it is safe to produce. It is expected that production will be reduced, but to what extent this will be necessary remains to be determined. Toteco-Cerro Azul has produced 152,139,753 bbl. of oil and it is reasonable to assume that it will continue to produce large quantities. The Mexican Gulf and Mexican Seaboard companies should be the chief beneficiaries, because most of their wells are higher up on the structure, according to the views expressed by Mr. Van Dyke. He adds:

"It is interesting to note that the Los Naranjos pool of 2.5 square miles has produced 53,675,223 bbl. of oil since salt water appeared nineteen months ago and is now producing 703,000 bbl. a month. The Topetati pool of 1.6 square miles has produced 17,027,054 bbl. since salt water appeared twenty-seven months ago and is now producing 406,000 bbl. a month. The lower Amatlan pool of 1.9 square miles has produced 22,120,630 bbl. of oil in the twelve months since salt water appeared and is now producing 973,000 bbl. a month. Zacamixtle, only seven-tenths of a square mile in area, has produced 1,486,000 bbl. of oil in the eighteen months since salt water appeared there and is now producing 125,000 bbl. a month, while Alamo, with an area of one square mile, has produced 4,837,000 bbl. and is now producing 579,000 bbl. a month. Toteco-Cerro Azul should produce oil proportionately to its greater area."

Domestic Production and Imports of Petroleum Increase

The American Petroleum Institute estimates that the daily average gross production of crude oil in the United States for the week ended July 1 was 1,454,200 bbl., as compared with 1,441,350 bbl. for the preceding week, an increase of 12,850 bbl. The following are estimates of daily average gross production for the weeks ended July 1, June 24, 1922, and July 2, 1921, the figures being in barrels:

	1922			1921
Region	July 1	June 24	Increase	July 2
Oklahoma	398,000	391,750	6,250	303,650
Kansas	85,600	84,000	1,600	103,700
North Texas	50,550	50,500	50	67,590
Central Texas	133,700	132,700	1,000	119,430
North Louisana and Arkansas	125,250	125,050	200	116,700
Gulf Coast	107,250	107,750	*500	89,080
Eastern	115,000	111,000	4,000	124,000
Wyoming and Montana	83,850	83,600	250	55,800
California	355,000	355,000	.....	336,000
Total	1,454,200	1,441,350	12,850	1,315,950

* Decrease.

Statistics of imports of crude and refined oil arriving at the principal ports of the United States are likewise compiled by the Institute as shown in the following table, in which the figures again are in barrels:

Port	Month of June	Month of May	Week Ended July 1	Week Ended June 24
Baltimore	759,000	1,017,867	252,000	187,000
Boston	371,000	802,000	140,000	90,000
New York	2,634,250	2,365,500	952,250	222,000
Philadelphia	1,036,900	988,000	270,800	82,000
Galveston district	1,440,000	1,370,000	383,000	338,000
New Orleans and Baton Rouge	1,613,370	2,144,614	427,000	284,370
Port Arthur and Sabine district	2,355,000	3,175,000	743,000	498,000
Tampa	90,000	30,000	.....	15,000
Others	1,425,717	1,583,190	455,000	216,000
Total	11,725,237	13,476,171	3,623,050	1,932,372
Daily average	390,841	434,715	517,578	276,053

Order of Railroad Commission Stimulates Oil Development in Pioneer Field in Texas

The Pioneer field in Eastland County, Tex., gives promise of developing into an oil producer of considerable magnitude. Work there was retarded for a time, but development is now being pushed since the Oil and Gas Division of the Railroad Commission has given permission to complete wells previously ordered shut down on account of inadequate pipe-line facilities. The Humble and Prairie companies now have pipe lines to this field, and the Texas Company is planning a third, which will have a daily capacity of 20,000 bbl.

The production of the Mexia field has fallen off to about 65,000 or 70,000 bbl. per day, but it should steady around these figures as the flush production is now off and the rapid drilling up of the smaller tracts is about completed. Larger blocks are drilled only around the boundaries for offset purposes, and large acreages in the middle of these tracts, as yet untouched, will supply the production in the future.

Several good wells have been completed recently in the coastal fields. At Orange the Hamilton Oil Corporation has completed two wells on the Chesson ground, one of them making 5,000 bbl., and the Amerada Petroleum Co. has brought in a second well in the bed of

Cow Bayou making 4,000 bbl. flush production from 3,400 ft. The Humble Oil & Refining Co. has completed its No. 24 Gaillard well at Goose Creek, making 3,000 bbl. from 4,185 ft. At West Columbia the Texas Company brought in the No. 53 Hogg well, making 7,400 bbl. flush production from 3,580 ft. This well is on the east side of the old field.

Several interesting developments are reported in the wild-cat areas of the coast. At Big Creek, the new salt dome near Richmond, Fort Bend County, the Gulf company has struck gypsum at 400 ft. in its No. 2 well, and will drill a third about one-half mile to the north. At Orange the deepest well on the Gulf Coast is being drilled by the Gulf Production Co. This is the No. 4 Kishi Lang drilling at 5,150 ft. At Stratton Ridge the Freeport Sulphur Company will drill another test southwest of No. 9 Dannenbaum, the discovery well, and the Fairchild Petroleum Company is drilling a well on the Boggs tract, a few hundred feet to the northwest of the Freeport well. Near Refugio, Refugio County, the Pratt-Hewitt well on the Rooke lease had a violent gas blowout which shot some of the drill stem from the hole and wrecked the derrick. The well bridged, and the gas flow was cut off.

Standard Oil Wants Wyoming Product for Canadian Refineries

It has been no secret that one of the principal reasons for entrance of the Carter Oil Co. into Wyoming was to find a supply of high-grade crude petroleum for works of the Imperial Oil Co., Ltd., situated at Regina, Saskatchewan. Imperial is subsidiary of the Standard of New Jersey, as is also the Carter company, says the *Inland Oil Index*. Imperial's plant at Regina has built up a large manufacturing, marketing, and distributing trade in Canada. Most of Imperial's crude requirement has been furnished by Ohio Oil Co. from its Wyoming production and was shipped in tank cars from Greybull through Great Falls to Coutts, just across the Canadian border, from which place it was transported north over the Canadian Pacific, a distance of 400 miles, to works at Regina. With an ample crude supply in northern Montana, it is only reasonable to suppose that the Imperial will build a refinery at some such convenient Canadian point as Coutts. As Canada admits crude petroleum free of duty, and has heavy tariff on refined products, the refining business in Canada has proved profitable in late years.

British Interests Buy Oil Rights from Sultan, Says Report

A report from Constantinople says that the heirs of the Sultan Abdul Hamid, with the consent of the Sublime Porte, have sold extensive property in the Mosul oil fields to a British syndicate for $5,000,000. The Angora newspapers declare the transaction illegal and urge the Nationalist government to ignore it. The reported deal is unconfirmed at Constantinople, but there has been great activity among the representatives of the oil companies for the last two weeks and a prominent Standard Oil man left for Angora recently. Special significance is attached to this as the Kemalists have not granted permission to any American to travel into the interior for many weeks.

Detailed Information Sought from Oil Companies in Senate Questionnaire

In connection with the investigation being conducted by the Senate Committee on Manufactures, pursuant to Senate Resolution No. 295, directing the committee to investigate, among other things, the conditions of the crude oil and gasoline markets during 1920, 1921, and the first six months of 1922, and the reason for the changes of price of crude oil, gasoline, and other products, the committee has prepared and sent to every branch of the industry schedules or questionnaires covering prices, organization, and business and financial conditions. These schedules are framed with the view of getting from the companies the latest and most complete information on the subjects covered by the resolution.

The purpose of the schedule on prices is to determine the prices paid by refineries for the crude oil or raw material, and the prices realized by them for the finished products. Its purpose is also to bring out the tank-wagon prices of gasoline and kerosene and the differentials existing between said prices and the retail or service-station prices. The schedule on organization and business is intended to develop the inter-corporate relations, if any, existing between the various companies engaged in the oil business, also to develop any common stock ownership that might exist, together with any strong connection existing by virtue of any financial relationship.

The financial schedule is intended to develop the financial condition of the companies in the various branches of the oil business during the period mentioned, also to bring out the profits made in the industry during this period. These questionnaires were sent to over 350 companies covering all the large refineries and producing companies and the principal marketing companies. The questionnaires were accompanied by a copy of the resolution and a letter of explanation so that the companies might be fully informed respecting the scope and purpose of the investigation. The companies have been requested to have the information in the hands of the committee by July 15.

Teapot Dome Development Commenced

The Casper-Mammoth Oil Co. expects to spud in this week on the first three of twenty wells on the Teapot structure, in Wyoming. This will form the quota of development required for the first eighteen months. Preliminary work on the survey for the right of way for the pipe line from Teapot to Kansas is completed. No further steps toward construction will be taken until production is developed in the field. The Standard Oil Co., which recently purchased a half interest in the Sinclair lines in the Mid-Continent field, will have an equal interest in the Teapot line and will stand half the expense of construction.

Japanese Company Organizes to Import Mexican Petroleum

The Japan-Mexican Oil Co. has been established in Tokio with a capital of 10,000,000 yen, one-fourth of which has already been paid up, according to Reuters. The company will import about 2,000,000 koku (47.6 gal.) of oil from Mexico every year through an arrangement made with the Mexican International Oil Co. The promoter of the company is Goro Matsukata.

SOCIETIES, ADDRESSES, AND REPORTS

International Convention Held at Nelson, B. C.

Resolutions Committee Against Motions Having Legislative Action as Objective

(By telegraph to the "Journal-Press")

IN many respects the International Mining Convention, which opened in Nelson, B. C., on July 3, was one of the most successful of the international series. The attendance did not equal that of previous gatherings, though various parts of the interior and of the coast of British Columbia were fairly well represented, with a few delegates from neighboring states and the Province of Alberta. Much enthusiasm and optimism were shown by all present, and the social features proved most enjoyable. The display of minerals was fair, but was practically confined to those of British Columbia.

The work of the resolutions committee is usually of much importance at a convention. At Nelson, an interesting recommendation was made by this committee to the effect that international conventions refrain hereafter from passing resolutions seeking to secure legislative action of any kind, on the ground that it was not right for an international convention to offer suggestions as to legislation or political action in the particular country in which the session happened to be held. The recommendation was adopted but not without some opposition.

The only resolution adopted was one commending William Sloan, the Minister of Mines of British Columbia, for his efforts to stimulate prospecting.

The formal opening took place on Tuesday morning, July 4, officially designated as American Day. In opening the convention, Lieutenant Governor Walter C. Nichol praised the part played by American capital in the development of British Columbia's mineral resources and stated that the industry served as one of the international bonds between Canada and the United States. He expressed the opinion that mining would continue to be the industrial backbone of the province of the English-speaking peoples.

An address by T. A. Rickard proved an attraction to many not directly interested in mining. The broadness of the views expressed by the speaker drew much favorable comment.

The rest of the program was largely made up of technical papers, or short addresses with some discussion. The contributors included S. S. Fowler, of Riondel; Douglas Lay, of Rossland; J. P. McFadden, of New Denver; L. G. Biggar, of Slocan City; S. G. Blaylock, general manager of the Consolidated Mining & Smelting Co. of Canada; J. Buchanan, of Trail; F. E. Woodside, of Vancouver; Nichol Thompson, of Vancouver, and William Sloan.

Mr. Sloan was optimistic as to the future of mining in British Columbia, and advanced figures in proof of his assertion that the provincial industry had come through the recent period of depression in very good shape as compared with other sections. Despite the large contribution to the provincial wealth made by precious metal mining, he predicted that in due time the production of base metals would prove the most important phase of the industry in the province.

Of more than ordinary interest was the announcement by General Manager Blaylock, of the Consolidated Company, that high-grade iron had been made in the electrolytic laboratory from pyrrhotite mined with Sullivan ores, indicating the possibilities of producing such iron as a by-product of electrolytic practice.

Work of Bureau of Mines Greatly Appreciated by Gas Men

At the meeting of the board of directors of the Natural Gas Association of America, held in Pittsburgh, Pa., on June 22, 1922, a resolution was passed approving of co-operation with the U. S. Bureau of Mines. The attention of the board had been called to an article that had been printed in a western newspaper regarding the relations of the Bureau and the Association, which from all reports had no foundation of truth and was in variance with the facts. After discussion, F. L. Chase introduced the following resolution, which was seconded by L. K. Langdon:

Whereas, there having appeared in a western newspaper an article during the last annual convention of this Association held in Kansas City, in which it was intimated that the work of the U. S. Bureau of Mines was not appreciated or deemed necessary by a large percentage of the gas industry in attendance at the convention, and in which it was further intimated that in all probability before adjournment, the Natural Gas Association of America would place itself on record as favoring the abolishment of the Bureau of Mines;

Be It Hereby Resolved, that the board of directors of the Natural Gas Association of America, in regular meeting assembled, do hereby disclaim any knowledge of such a sentiment or such a movement as above referred to and wish it to be publicly known that the statement as issued had absolutely no basis of truth and was in complete variance with the facts.

Outlook for Iron Ore Industry in Ontario Discussed

Steel Men and Others Meet in Toronto —Beneficiation of Low-Grade Material Considered

About forty mining men, steel manufacturers, engineers, transportation officials, and others interested in the development of the iron ore industry of Ontario attended a conference called by the Provincial Government at the Parliament Buildings, Toronto, on July 5. The chair was occupied by Harry Mills, Minister of Mines.

C. W. Knight, of the Department of Mines, and J. D. Jones, general manager of the Algoma Steel Corporation, presented papers describing the iron ore deposits. G. C. MacKenzie explained the methods of magnetic concentration for low-grade magnetite ores, the processes for increasing the metallic content of siliceous hematites, and the roasting and nodulizing of siderites.

A keen discussion took place, led by J. D. Jones, as to the economic possibility of applying these or other methods of beneficiation to the low-grade deposits, in competition with the American ores. It was pointed out by Mr. Jones that although hitherto it had been impossible to meet this competition, the high-grade ores of Marquette were approaching exhaustion. American producers realized this and had recently erected a plant costing $4,000,000 for the beneficiation of ores stated to be of a lower grade than those available in Ontario. Although most of the speakers were disposed to take an optimistic view of the opportunities presented, it was realized that to insure success operations would have to be on an extensive scale, necessitating heavy initial expenditure yielding no returns for several years. The suggestion that the enterprise should be aided by the government was generally approved.

The question as to how far a market could be found in Ontario for beneficiated ores gave rise to some discussion. J. G. Morrow, of the Steel Co. of Canada, in reply to statements that the manufacturers were unwilling to use Canadian ores, said that his company was prepared to do so, but that they must have a definite proposition. Col. John A. Currie, of Toronto, said that manufacturers contracted for ores at the beginning of the season and must have guarantees as to deliveries, sulphur and phosphorus content, etc., otherwise they could not be expected to use domestic ores.

Mr. Jones said that ores with only

18 per cent of iron were now being developed in New Jersey, and the economic production of the Canadian ores would be possible on a basis of 60 per cent of sintered siderite and 40 per cent sintered magnetite. If they were given Canadian ores at a competitive price with American ores, the Algoma Steel Corporation would use Canadian ore exclusively.

W. Rowland Cox, engineer, of New York, stated that the Moose Mountain ore with 35 per cent iron content, no phosphorus and very little sulphur could successfully compete with ore from the United States, but its development would be a costly undertaking with profits deferred for ten or twelve years.

Resolutions were adopted calling on the Canadian and Ontario governments to afford state aid for a period of fifteen years to operators developing iron mines, and requesting the Provincial government to appoint a committee, consisting of at least one metallurgist, one geologist and one transportation expert, to investigate and report on the various phases of the iron industry.

Mr. Wills stated that the government would appoint the committee asked for.

MEN YOU SHOULD KNOW ABOUT

Karl C. Parrish has returned to Barranquilla, Colombia.

George A. Packard is examining property in Southern California.

Frederick Bradshaw is in Tonopah and will leave shortly for Surf Inlet, B. C.

E. M. Hamilton expects to leave San Francisco for Mexico on professional work about July 15.

E. P. J. Burgess, of Butte, Mont., has returned home after a three weeks visit in New York City.

A. J. Collier and **W. W. Boyer** are doing geological work in the Big Horn Basin of Wyoming.

O. J. Egleston, chief engineer for the U. S. Smelting, Refining & Mining Co., was recently in San Francisco.

J. K. Turner, of Goldfield, Nev., is leaving New York after an extended visit, and will go to Oatman, Ariz.

R. D. Mesler returned on July 3 from field work for the U. S. Geological Survey in Tennessee and Virginia.

R. L. Lloyd, vice-president of the Dwight & Lloyd Metallurgical Co., has returned from a ten-week trip abroad.

R. C. Moore and party have headquarters at Panguitch, Utah, and are working southward on the Kaiparowitz plateau.

R. L. Chase, of Denver, has left to spend a month on examination work in the San Juan district in southwestern Colorado.

David Cole, who recently returned to El Paso from inspection trips to Cananea, Mexico, and Clarkdale, Ariz., was in Los Angeles on July 6, and will sail from Seattle to Anyox, B. C., on July 16.

C. T. Hutchinson, formerly business manager for the *Mining and Scientific Press,* and now with the McGraw-Hill Co., is visiting New York.

D. W. Brunton, J. Vipond Davies, and **J. Waldo Smith** have been appointed consulting engineers for the Moffat Tunnel Commission in Colorado.

J. D. Sisler, of the Pennsylvania Geological Survey, is spending the summer mapping the geology of the Myersdale quadrangle in the southwestern part of the state.

Fred G. Farish, general manager of the Metals Exploration Co., is spending the months of July and August looking over the various interests of the company in California and Nevada.

E. O. Ulrich will sail for Europe on July 12 to represent the Smithsonian Institution and the U. S. Geological Survey at the International Geological Congress, which meets in Brussels Aug. 10 to 19.

H. B. Carlton, of the research department of the University of Pennsylvania, who is making a tour through Canada, investigating the peat industry, recently visited the government peat field at Alfred, Ont.

S. Matsukuma, general manager of the Mitsubishi Mining Co., Ltd., of Tokyo, Japan, was recently in San Francisco. He will make a tour of the principal coal-mining centers in the United States.

M. E. Johnson, of the Pennsylvania Geological Survey, visited the Tidioute oil pool in the northwest part of the state a few days ago, and will soon resume geologic mapping of the Pittsburgh quadrangle.

Dean Milnor Roberts, of the University of Washington College of Mines, has recently returned to Seattle, after making examination of a mine and milling plant in Montana, and mining property in northern Washington.

C. F. Sturtevant, mining engineer of Salt Lake City, Utah, has been examining properties in the Crown King and Big Bug districts, Yavapai County, Ariz., accompanied by **Andor Syverson** and **R. Kingdon,** formerly of the United Verde Extension Mining Co.

E. G. Sievers, who has been in charge of the U. S. Geological Survey statistical and geologic work on natural gas and natural gas gasoline, has been transferred from the Survey to be an assistant valuation engineer in the Oil and Gas Section of the Bureau of Internal Revenue. Mr. Sievers began work in his new position on July 10.

W. A. Howard, who has been in the employ of the United States Smelting Co. from 1904 to the present time, first as ore settlement clerk, then as chief ore buyer, and later as assistant general manager, is going to Cornell University for special study. Mr. Howard resigned as assistant general manager at the end of 1921 but remained with the company until now.

W. H. Eardley, formerly with the United States Smelting Co. at Salt Lake City, and since 1920 having had headquarters in New York, where he was engaged in various phases of mining operations, among other things on special work for the United States company, is returning to the employ of that company as assistant general manager at Salt Lake City, **D. D. Muir, Jr.,** being general manager. Mr. Eardley was ore purchasing agent for the United States company from 1908 to 1915. In 1915 he investigated the zinc situation for the company in the middle west, and later was placed in charge of the company's mines and smelters in Missouri. In 1917, he became general manager for the American Metal Co., operating mining and milling property in Kansas, Missouri, and Oklahoma.

Colonel Arthur S. Dwight, president, and **Charles F. Rand,** past president, of the American Institute of Mining & Metallurgical Engineers, have received from the French Government the Croix de Chevalier de la Legion d'Honneur. The formal presentation of these honors will be made at the Engineers' Club on July 20 at a luncheon given to **Gaston Liebert,** Consul General for France. Colonel Dwight served conspicuously with the 11th Engineers and was given the D. S. O. by the British government. Mr. Rand has been one of the leaders in all engineering movements for many years and was honorary secretary of the delegation of engineers, of which Colonel Dwight was also a member, which visited England and France in the summer of 1921 to confer the John Fritz Medal on **Sir Robert Hadfield** and **Eugene Schneider.**

Mining and metallurgical engineers visiting New York City last week included: **W. G. Wright,** of Buenos Aires, Argentina; **John W. McKim,** of Casper, Wyo.; and **Fred B. Ely,** of Hoosick Falls, N. Y.

SOCIETY MEETINGS ANNOUNCED

The International Congress of Engineering will be held under the auspices of the Brazilian government at Rio de Janeiro, Sept. 7-30, in connection with the opening of the Brazilian International Exposition and other features of the celebration of the first centennial of Brazilian independence.

OBITUARY

Fred R. Mellis, of the Oregon-Idaho Investment Co., Baker, Ore., died recently of apoplexy. He had been associated with the mining industry of eastern Oregon for an extended period, one of the enterprises of the Oregon-Idaho Investment Co. being a sampling mill at Baker.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

NEVADA Consolidated's concentrator at McGill, Nev., was partly destroyed by fire on the evening of July 9.

The increased number of independent shippers to the Trail smelter reflects general activity in the British Columbia mining districts.

The Copper Export Association has called notes of 1923 and 1924 issues for payment before maturity. The unsold stock of copper has been reduced to 180,000,000 lb.

A new power plant will be built to supply hydro-electric energy to the Consolidated Mining & Smelting Co., of Canada.

The Tamarack & Custer and the Hercules mines in the Coeur d'Alene district, Idaho, have resumed production. A temporary shortage of miners has been the consequence.

Railroads have made a voluntary reduction in freight rates on ores to the Salt Lake Valley smelters. This is expected to stimulate production.

A possible strike of crews on the Lake Superior boats threatens to reduce iron ore shipments. The record is good to date.

The Simon Silver-Lead company will suspend production for six months pending the completion of its new shaft and alterations in its mill.

Fire Partly Destroys Nevada Consolidated Concentrator at McGill

Fire on the night of July 9 destroyed part of the main building of the Nevada Consolidated mill at McGill, Nev. According to reports the crushing plant is untouched and the result of the fire will be the reduction of operations to about half capacity for a few months while the damaged sections are being restored. High-grade ore from the Ruth mine will probably be drawn upon heavily to make up for the reduced tonnage of low-grade mill ore. The smelter is unaffected. The capacity of the mill is 10,000 tons per day.

A. S. & R. Co. Puts Colorado Operations in Charge of Utah Officials

The Utah Department of the American Smelting & Refining Co. on July 1 was placed in supervision of the Colorado plants of the corporation. This gives the Salt Lake office supervision over the Arkansas Valley plant at Leadville and also over the Durango smelter. J. M. Bidwell is general manager of both the Utah and Colorado departments of the company.

Australian Zinc Production

By Cable from Reuters to "Engineering and Mining Journal-Press."

London, July 10—The Electrolytic Zinc Co. of Australasia produced 1,981 tons of zinc during the month ended June 28.

Copper Export Association Calls Notes Due in 1923 and 1924

More Than Half of Original 400,000,000 Lb. of Metal Has Been Sold

The Copper Export Association is calling for repayment in August of $3,000,000 of its 8 per cent notes due Feb. 15, 1923, and $6,000,000 of the notes due Feb. 15, 1924. The retirement price of 1923 notes is 101, and of the 1924 notes 102. Up to the present the association has applied against bonds the proceeds of about one-fourth of its total sales of copper. With domestic sales improving, a much larger proportion of foreign sales can be applied against bonds if desired.

The original $40,000,000 8 per cent notes, which will be reduced to $18,000,000 by retirements on Aug. 15, was made Feb. 15, 1921, and originally consisted of $6,000,000 maturing at end of one year, $10,000,000 in two years, $12,000,000 in three years, and $12,000,000 in four years. The issue was against credit of the companies participating, which comprised most of the leading copper producers, and was covered specifically by 400,000,000 lb. of copper. The present bonds outstanding show that out of this original amount only 180,000,000 lb. of copper remain unsold. On Aug. 15, 1921, the Association redeemed $1,000,000 of the $6,000,000 maturing Feb. 15, 1922. On Feb. 15, 1922, it redeemed the remaining $5,000,000 of that maturity and $7,000,000 of the $10,000,000 maturing Feb. 15, 1923. Every issue has been redeemed before the date of maturity, thereby indicating that the recovery of the industry has been as rapid as expected.

New Power Plant Will Be Built to Supply Consolidated Mining & Smelting Co. in British Columbia

The East Kootenay Power Co. has entered into an agreement to supply the Consolidated Mining & Smelting Co. with power to operate all the mining machinery at the Sullivan mine and the new concentrator in process of construction at Kimberley for the next ten years. The contract calls for the delivery of 8,000 hp. The East Kootenay company will build a new power plant on the Elk River to meet this and other requirements, its present plant on the Bull River being insufficient for this purpose. Plans for the new station are being rapidly completed.

Better Tone in Mining Industry in British Columbia

The increased number of independent shippers indicated in the smelter receipts at the Trail plant which amounted to 9,669 tons for the third week in June, show better than anything else the improvement in mining conditions. The following were the mines shipping: California, Nelson, 32 tons; Florence, Princess Creek, 99; Highland, Ainsworth, 35; Ottawa, Slocan City, 11; Quilp, Republic, 104; Ruth, Sandon, 45; Silversmith, Sandon, 239; Silver Horde, Ainsworth, 17; Silver Standard, New Hazelton, 30; Sovereign, Sandon, 17; Surprise, Republic, 159; Sullivan, Kimberley, 8,889; and White Elephant, Ewing, 38.

Swedish Iron Ore for British Steel Plants

Reuters News Service

Svenska Dagbladet says that speeches made at the meeting of the Iron and Steel Institute recently seem to indicate the probability that Sweden will occupy a more important position than hitherto as a supplier of iron ore to the British Isles. Sweden, says the paper, can undoubtedly fulfil the conditions demanded, namely, a regular and sufficient supply of good ore of equable quality, since in addition to the ore in northern Sweden there are larger stores in middle Sweden than is generally supposed. This ore also is suitable for British furnaces, but the transport costs are at present too great owing to the high Swedish railways rates.

Railroads Cut Freight on Ores and Concentrates to Salt Lake Valley Smelters

Freight rates on ores from the Tintic district in Utah, and from points in Nevada and California, to the Salt Lake valley smelters have been reduced by the railroads carrying these ores. A considerable tonnage of the Tintic output is low-grade (not much of the ore will run over $50 per ton) and the railroads in question (the Union Pacific and the Denver & Rio Grande) have made the reduction voluntarily in the belief, induced by the representations of mining men, that several properties now idle will be able to resume operation, with one important item of overhead expense so greatly lessened. The increased volume in shipments is of course expected to offset the lower rate per ton to the railroads, and it is probable that this will be more than made good. In order to have the new rates go into effect as soon as possible during the season of summer activity, the Public Utilities Commission will be asked to shorten the notification period so that the new schedule may become effective July 10. The present reductions are independent of the general freight reductions July 1, as there was no increase in freight rates within Utah in August, 1920.

The official schedule follows:

From Tintic district, including Silver City, Mammoth, Eureka and other shipping points:

Iron ore—Reduced from $1.50 per ton to $1 per ton.

Ore and concentrates—Value $3.50 per ton, reduced from $1.30 to $1; value $5 per ton, from $1.40 to $1; value $10 per ton, from $1.60 to $1; value $15 per ton, from $2.20 to $1.25; value, $20 per ton, from $2.80 to $1.25; value $30 per ton, from $3.10 to $1.50; value $40 per ton, from $3.10 to $1.75; value $50 per ton, from $3.10 to $2; value $60 per ton, from $3.80 to $2.25; value $70 per ton, from $3.80 to $2.50; value $80 per ton, from $3.80 to $2.75; value $90 per ton, from $3.80 to $3; value $100 per ton, from $3.80 to $3.25.

There are no changes in the schedule of ore of more than $100 per ton value.

Lake View Star Suspends Operations

By Cable from Reuters to "Engineering and Mining Journal-Press."

Melbourne, July 5—The Lake View Star mine at Kalgoorlie has been closed for an indefinite period owing to the high production costs and the declining yield.

Shipments of Iron Ore from Lake Superior Are Large

Shipments of iron ore from the head of the lakes showed a substantial gain during June. The total shipments from the docks at Duluth, Superior, Ashland and Two Harbors for the month were 5,718,637 tons which is a gain of 2,295,374 tons over a like period in 1921. The total shipments for this season now amount to 7,152,039 tons which in comparison with the same period during the 1921 season, shows a gain of 1,044,571 tons. Due to the many obstacles that delayed the movement of ore in the early stages of the season, the grand total to date is not very large but large tonnages should be handled every month until the season closes and there is every likelihood that the season's estimate of 40,000,000 tons will be reached, if not passed.

Many of the companies such as the Pittsburgh Steamship Co., the Interlake Steamship Co. and the Shenango Furnace Co. are operating every boat in their fleet including the barges. It is unfortunate that a strike vote is now being taken by between 12,000 and 15,000 employees on Great Lake vessels. The vote is being taken at the various ports on the lakes and includes such trades as marine firemen, oilers, cooks, stewards, water tenders and coal passers. A strike of long duration at this time will greatly impede the contemplated shipments and it is to be regretted that such conditions have arisen at a time.

Michigan Copper Miners Continue Migration to Manufacturing Centers

The labor exodus from the Copper Country continues. Automobile and other factories in Michigan and Wisconsin industrial centers are the chief beneficiaries of this movement. Some of the mines, as a result, are working short-handed even on the present basis of curtailed production. The men, it is believed, are not attracted so much by higher wages elsewhere as they are by a desire to seek surface employment. Employers elsewhere are making raids on labor in this district, agents having come into the Copper Country seeking men and offering inducements for them to leave. There is a feeling, however, that labor conditions will be considerably improved when the automotive industry begins to curtail production in the early fall and that the mines will then be able to recruit their underground forces to the required number.

Day Mines Resume Production in Coeur d'Alenes—Looks Like Peace with A. S. & R. Co.

BY A. J. DUNN

After a complete suspension of production for fifteen months, the Tamarack & Custer Consolidated Mining Co. and the Hercules Mining Co. of the Coeur d'Alene district, Idaho, are again on the active list. Up to the time of suspension the Tamarack was operated under the management of Jerome J. Day, and the late Eugene R. Day was manager of the Hercules. The third brother, Harry L. Day, held the position of traffic director of the Day interests and until a year or more ago, when ill health forced his temporary retirement, gave his attention to the marketing of the metal products of the Northport smelter at Northport, Wash., and the Pennsylvania refinery at Carnegie, Pa., both controlled by the Days.

The resumption of operations at the Day mines is accompanied by a remarkable change in the executive lineup. Eugene R. Day died last February. Jerome J. Day is suffering from the results of an attack of influenza which occurred a few weeks after the death of his brother. In the meantime Harry L. Day has apparently recovered and is now in Wallace giving his attention to the resumption at both mines.

The most interesting feature of resumption has to do with the disposition of Day ore shipments. About ten years ago the Days objected to the terms imposed by the American Smelting & Refining Co. in the contract under which they had been shipping their ore, and finally decided to embark in the smelting and refining business themselves. They thereupon purchased the old Northport smelter and put it in shape to meet their requirements and also took over the refinery at Carnegie, Pa. At the time the Tamarack and Hercules suspended operations more than a year ago it was believed by many that inability of the Days to market their lead in competition with larger and more favorably situated competitors was one of the chief causes of the suspension, although the reasons given out were the low price of lead, high mining costs, the excess-profits tax, and the high freight rates. Whatever the reason, a change seems to have taken place. Almost coincidental with the announcement of a resumption at the Day mines came the news that Harry L. Day had been elected a director of the American Smelting & Refining Co. At about the same time a deal was closed whereby the Tamarack company secures the right to use No. 6 tunnel of the old Standard-Mammoth mine, owned by the Federal Mining & Smelting Co., a subsidiary of the A. S. & R., which will be extended 1,500 ft. and form a permanent outlet for the Tamarack mine. This will eliminate the long and troublesome tramway and enable the company to deliver the ore at a point easily accessible to the mill. Although no offi-

cial information is obtainable, the election of Mr. Day as a director of the A. S. & R. company and the securing of this valuable concession from the Federal are taken to mean that the ore from the Tamarack and Hercules will be shipped to the East Helena plant of the American Smelting & Refining Co., and that that company will take over the Northport smelter.

Gold Output of Siberia Increases

Reuters News Service

The Russian Trade Delegation reports that Siberia produced during the first four months of the present year over 16 poods (36.1 lb. per pood) of gold. This quantity is five times greater than the total output for 1921. The Gold Syndicate has succeeded in re-starting the gold-mines at Elisatevinsk, Alexandrovsk, Ivanovsk and Youzhnotaiginsk, which it is estimated will ensure an output of no less than 3 poods monthly.

Sale of Junk Writes Finis to Old Central Mine in Michigan

The sale of equipment and machinery involving 4,000 tons of iron and steel at the old Central mine in Keweenaw County, Mich., to a junk dealer, recalls the active days of this property, which, in the earlier years afforded employment to a large number of men and returned substantial profits to its owners. The Central was opened in 1854 and for nearly forty years was a steady dividend payer. The mine was closed down in 1898. Up to that time, Central was a thriving community, one of the largest in the Lake district.

Central was opened on a fissure vein, and produced copper and silver marketed for $9,770,528. Some revenue also was derived from the sale of timber. Of the gross receipts, only $2,479 was expended for lands. Of the balance, the shareholders received $1,970,000 in dividends while $7,982,712 was expended for current operations.

Mayo, in Yukon Territory, Thrives—Housing Inadequate

Recent reports from the Yukon state that hotels and private houses are being pulled down at Dawson and are being transported to Mayo. Despite the large influx of people, labor is in great demand in the mining districts; men are needed for the erection of buildings at Mayo. There is not sufficient accommodation for the people who already are there, and men are camping in boats, under canvas, and practically anywhere that will provide slight protection. The Yukon Gold Co. is said to have blocked out a large reserve of ore, as also have the Treadwell interests. Everyone seems to have unlimited faith in the camp, the only drawback being lack of transportation facilities. It is thought that when the Dominion Government realizes the importance of the new districts these will be provided.

News from Washington

By PAUL WOOTON
Special Correspondent

One Award, Five Disallowances, Recommended to War Minerals Relief Commission

An award of $103,527.30 in favor of the Georgia Iron & Coal Co., of Atlanta, Ga., has been recommended by John Briar, assistant to the War Minerals Relief Commission. Judge Ira E. Robinson, the War Minerals Relief Commissioner, did not sit in this case because he had been requested, prior to his appointment, to appear before the former War Minerals Relief Commission as counsel for the claimant. Although he did not accept the tender of employment, he asked that the case be handled by Mr. Briar.

The former commission had granted an award of $55,406.11 in this case. The additional award is based on an earlier date of stimulation and on the belief that the claimant should be reimbursed for the purchase price of a washing plant, less an allowance of $15,000 for salvage value. The claimant originally asked to be reimbursed to the extent of $171,757.12 for losses sustained in the production of manganese.

Under the present findings, the date of stimulation was fixed as of Aug. 1, 1917, whereas the old Commission had dated stimulation from March 22, 1918. In addition to the Georgia Iron & Coal Co., the Pratt Engineering & Machinery Co. and Joel Hurt were interested in the case.

Other recommendations made subject to the approval of the War Minerals Relief Commissioner, are: Charles A. Walcott, Boulder, Col., disallowed, net loss not established; Peru Mining Co., Salt Lake City, disallowed, not reimbursable under the Act; Samuel Altshuler, San Francisco, disallowed, commercial importance not shown; W. P. Kendall, Muskogee, Okla., disallowed, commercial importance not shown; and Southern Pyrites Ore Co., Atlanta, disallowed, commercial importance not shown.

More Tariff Amendments Proposed—Platinum To Be Protected—Senator King Far From Being Satisfied

In an amendment to the tariff bill Senator Poindexter, of Washington, proposes a duty of $30 per oz. on the metallic content of ores of the platinum metals and $50 per oz. on platinum, unmanufactured or in ingots, bars, sheets or plates, sponge or scrap. In the pending tariff bill before the Senate these articles are on the free list.

Duties on lime and limestone are proposed as follows in an amendment by Senator Jones of Washington: Lime in cooperage, 50c. per 100 lb.; in bulk, 30c.; hydrated, 40c.; broken or crushed limestone, 15c.; ground limestone in bags 7½c. and in bulk 5 c. per lb.

Senator King, of Utah, has announced that he will offer a thousand amendments to the chemical schedule when that section of the revised tariff bill is taken up for final action. He indicated, however, that he will debate only a small proportion of these amendments.

Investigation of Iron-Ore Charges Is Dropped

The Interstate Commerce Commission has discontinued its investigation as to the reasonableness of storage, dockage, and handling charges on iron ore at Lake Superior docks as the carriers have withdrawn the schedules.

Proposed Silver Export Association Arouses Country-wide Interest

Returns to the American Gold and Silver Institute indicate active interest throughout the country in the proposed Silver Export Association. A high Government official thoroughly conversant with the mining industry, in discussing the plan, stated that nowhere is the need of a large unified marketing organization greater than in the export trades, particularly in those commodities where foreign munipulation has an important influence on prices. The difficulty is, he pointed out, that many American producers are the spoiled heirs of rich heritages and do not co-operate readily. Where the product goes abroad this official believes that co-operation should be the rule and that competition should be only an incident.

New Division of Receipts Under Leasing Law Is Proposed

A bill changing the present method of dividing receipts under the leasing law has been introduced by Senator Kendrick of Wyoming. It provides that 10 per cent of all receipts from sales and royalties, except in Alaska, under the law shall revert to the Federal Government; that for past production 70 per cent, and for future production 52½ per cent, shall go into the Government reclamation fund; and of past production 20 per cent, and of future production 37½ per cent, shall be paid to the states in which the lands are located. The bill further stipulates that the receipts from lands in naval petroleum reserves shall go to the Government.

Adequate Consideration of Mine-Law Revision Urged on Congress

Federated Engineering Societies Addresses Letter to Chairman Rhodes of House Committee

The Federated American Engineering Societies is taking active interest in the legislation now before the Committee on Mines and Mining, of the House of Representatives, which provides for the revision of the mining law. Representative Rhodes, the chairman of the Committee on Mines and Mining, has received the following letter from L. W. Wallace, the executive secretary of the federated societies:

"Interest in the bill providing for the revision of the mining laws is not confined to mining engineers. All branches of engineering are concerned with this effort to bring legislation in step with industrial development.

"This organization is not so much interested in the form the bill may take finally, as it is in seeing that the consideration of this measure be not allowed to languish. We want to see all opinions brought out so that the most intelligent action may be taken.

"I have looked over the two volumes of your hearings. There is reference to powerful opposition to the bill, but the hearings do not contain any comprehensive presentation against the proposals put forward. I assume there will be further hearings at which the opposition will be heard in detail.

"The engineering profession as a whole are anxious to have all the illumination obtainable on this subject. Unless more evidence against the bill is presented than appears in your hearings, it seems to me that but one conclusion could be drawn, and that is that the bill be amended in some of the particulars suggested and reported favorably. As the record stands, I hardly see how the Committee can refrain from prompt action in the effort to remove the restraints from the mining industry which it is contended are causing it to languish. I have no doubt that the Committee has information, not in the hearings, that justifies further consideration before action is taken. A better case probably can be made by the opposition and I am wondering if it is your plan to have a further hearing with the special intent of making a record of the arguments against the bill?

"The principal interest of this organization, however, is to prevent delay in the threshing out of this matter, which has such an important bearing on the prosperity of one of our fundamental industries. I hope it is your plan to continue the hearing until a complete record has been built up. I would like very much to acquaint the engineers of the country with your views."

Duty or Bounty?

Bounties on Potash and Manganese Would Operate Differently

The decision of the Senate Finance Committee to put a bounty on potash to replace the proposed duty has caused much discussion of the advisability of extending the plan to other commodities. Some are of the opinion that it could be applied successfully to manganese and other commodities where there is no early opportunity of developing domestically more than a small proportion of the country's requirements.

In the case of potash, a duty means that the tax will be paid largely by the farmers. A bounty will cost less and will allow that lesser burden to be divided equally among all taxpayers. In the case of manganese, the situation is somewhat different. The tax at the Custom House would fall largely on the steelmakers. In their industry, however, it is comparatively easy to pass the tax on. This means it will be collected ultimately from the construction industries. The tariff makers are particularly anxious to encourage these industries and are trying to avoid adding to their burdens any more than is necessary. This is one of the reasons for the very determined opposition to high rates on ferro-alloys.

News by Mining Districts

Melbourne Letter

Railroad from Broken Hill to Sydney Hinges on Future of Mining Operations—Controversy Over Smelter Charges

BY PETER G. TAIT

Melbourne, June 13—Although situated in New South Wales, the Broken Hill field has always found its outlet through South Australia, and has added in no small way to the prosperity of the latter state. For several years the construction of a railway which will give Broken Hill connection with Sydney has been proceeding and today about 100 miles of line remains to be laid. The present government is considering the desirability of proceeding with this work, and naturally the future of Broken Hill is a determining factor. According to evidence submitted to the government, the total yield of minerals from the district exceeds £111,500,000 and the total is probably much larger, the incomplete nature of the returns making the exact amount difficult to ascertain. Dividends paid have amounted to about £26,500,000. From the main Broken Hill lode, three miles in length, the amount of ore raised has been about 32,000,000 tons, and the ore reserves are at least 13,000,000 tons, based on the 1919 estimates. Representatives of the industry are responsible for the statement that, if the line is built, a roasting plant to treat 75,000 tons of concentrate per annum will be established in the neighborhood of Sydney. The Broken Hill Associated Smelters has acquired an area of ground adjacent to Sydney for the erection of such reduction works.

In a recent letter reference was made to the contract between the British Broken Hill Co. and the Broken Hill Associated Smelters for the treatment of their concentrate. The Junction North Co. is now entering the lists, the directors in their half-yearly report just issued stating that "the increased costs of the Associated Smelters have been caused somewhat by higher costs of wages, stores, and freights, but chiefly by overwhelming overhead charges due to creation of top-heavy managerial departments, and heavy writings-off necessitated by injudicious constructional programs and welfare schemes." The Broken Hill Associated Smelters in a reply to this statement point out that the contract in existence is framed on a co-operative basis and they claim that all those supplying ore for smelting will obtain the benefit of more favorable returning charges as the smelting costs decline. They go so far, however, as to offer to vary the present contract by putting the Junction North Co. on a fixed returning-charge basis for its whole output over the period of the present contract, full lead and silver contents of the concentrates delivered at Port Pirie being paid for at average London prices, less a smelting and realization charge equivalent (with lead at pre-war average price) to £9 10s. 0d. per ton of lead contained.

London Letter

Gloomy Outlook for Great Boulder Operations—Ropp Tin Turns 1920 Deficit into Satisfactory Profit, and Declares Dividend

BY W. A. DOMAN

London, June 30—Following what I recently wrote concerning the Geduld Proprietary Mines comes some interesting information on the development position. It will be remembered that the future of the mine depends largely upon the southern area. The sinking of No. 7 shaft to serve this ground was completed last year, but work in connection with the underground layout will not be finished until well into next year. At about the end of next September ore in this section can be drawn upon. These claims contain 20 per cent of the ore reserves, and at present supply only 4 per cent to the mill. Development in the southern area during the current year seems to be up to last year's standard, though relatively little work has been done. Total advance in drifts, raises and winzes amounted to 7,325 ft.; the reef averaged 66 in. thick, the assay value was 15.4 dwt. and 63 per cent of the ground was classed as payable.

Apparently the capital account is about to be closed, for the chairman stated at the meeting at which the above information was given that in future "the bulk of the profits earned, after making allowance for the tax collector, will go into the pockets of shareholders."

At the annual meeting of the Great Boulder Proprietary Mines on Tuesday, Sir George Doolette rather astonished shareholders by telling them that, owing to the unfavorable labor conditions in Australia ore containing less than 14 dwt. of gold could not be profitably worked. In the ordinary way this would be high grade ore. The result is that ore above the average is being mined, and at present the monthly tonnage is reduced to a point that is simply sufficient to carry on. No dividend was declared, and it is impossible to say when the next will be earned. Presumably until labor abates some of its demands, the Great Boulder will simply continue on a minimum scale. The directors are looking for other properties, but have abandoned Australia as an impossible country.

Although Ropp Tin is one of the most important mining companies in Nigeria relatively little information is given in the report covering the operations of 1921. It seems to be a kind of mining custom to say little about an undertaking when results are good and to issue a small brochure when things are unfavorable. The 1921 results of Ropp Tin show a complete *volte face* when compared with 1920. In the earlier period there was a loss of £7,595; in the past twelve months the profit amounted to £17,021. Mining costs are not specifically set out but they were "considerably lower" than for the previous year. If output and expenditure in Nigeria alone be taken the average cost per ton in 1920 was £96.7 and last year £52.8. As the outcome of the above a dividend of 10 per cent is paid, whereas there was none the preceding year. The ore reserves are estimated at 8,785 tons, in contrast with 10,006 tons.

The Waihi Gold Mining Co. publishes a cablegram stating that the report of P. G. Morgan, director of Geological Survey for the New Zealand Government, endorses the proposed program of prospecting at depth.

KOREA

Oriental Consolidated Has New Shaft Ready For Use

Unsankinko—The Oriental Consolidated Mining Co.'s output for May was as follows:

Tabowie mill bullion	$18,954.27
Taracol mill bullion	23,124.25
Taracol cyanide-plant bullion	46,528.14
Premium on gold (April)	298.45
Total value	$88,905.11

The new Tabowie headframe has been completed. The installation of rails in the new Tabowie shaft is nearly completed. It is expected to complete the new stations and pockets for the new shaft during July. Underground hoists on No. 8 level, a dumping gear at No. 8, and sheaves for the new headframe must be installed before the shaft will be ready.

The company is overhauling all of its underground equipment so as to have it in order for the rainy season.

AUSTRALASIA

New Guinea Copper Mines To Be Refinanced With Government Assistance

Victoria—The New Guinea Copper Mines, Ltd., has an authorized capital of £500,000, half in 10 per cent cumulative participating preference and half in ordinary shares of £1 each, of which 125,000 preference (5s. paid the balance of 15s. has been called up) and 244,625 ordinary, fully paid, have been issued.

The company was incorporated in Victoria in 1920, to acquire the leases of the Laloki and other mines, mining areas, and options on leases in New Guinea. The price paid was £162,295, of which £22,295 was satisfied by the company taking over the bank overdraft and sundry creditors of the vendors, £400 in cash, £24,000 in series "A," and £15,200 in series "B" non-interest bearing bonds repayable only out of profits, and the balance of £100,000 by the issue of 100,000 fully paid shares. The company has entered into an agreement with the Government of the Commonwealth of Australia by which the latter has agreed to purchase the company's railway line, rolling stock and plant, and wharf for £45,000, and further to lease the property so acquired back to the company for ten years at a rental equal to 6 per cent of the purchase price.

Johannesburg Letter

Rand Mines, Ltd., Produced £20,261,249 Realizing 105s. 6d. Per Ounce—Geduld Will Increase Capacity of Plant by 50 Per Cent

BY JOHN WATSON

Johannesburg, June 6.—A statement prepared by the Chamber of Mines showed that the number of white men in service at thirty-nine gold mines at the end of December last was 19,838 and at the end of March the number was 12,722. By the end of April this number had reached 14,338. If the number of natives approximated that of December last it is estimated that 16,139 Europeans would be employed. An addition of 10 per cent might be made to this number for relieving men, owing to holiday privileges and sick-leave, which would bring the entire total of whites up to 17,753. The difference between this total and the December total was only 2,085 and of these only 616 cases would be due to the abolition, or suspension, of the *status quo* agreement.

The net gain of native labor for May, at the gold mines of the Rand, is 17,951 which brings the total gain since March 30 up to 31,692. It will require a further gain of 23,000 natives to bring the number up to that employed before the strike. For every ten natives gained, another white man is employed.

The annual meeting of the Union Corporation, Ltd. (formerly Ad. Goerz & Co.), was held in Johannesburg on May 29. The company has added £30,000 to reserve account, bringing it up to £150,000, declared and distributed a dividend of 2s. per share, the same as last year, leaving a balance of £77,872 carried forward to this year.

The Geduld Prop. Mines has decided to increase, as soon as possible, the capacity of its reduction plant by about 50 per cent, so as to treat 65,000 tons of ore per month.

The annual meeting of the Rand Mines, Ltd., was held on June 2. The sixteen milling companies which they administer had produced in 1921, £20,261,249 worth of gold at an average realized price of 105s. 6d. per ounce. The value for 1920 had been £20,773,362, the average price realized being 110s. 9d. per fine ounce. Two dividends were paid for 1921 by this parent company, absorbing £372,049. The mortality from accidents in mines of the group had been 2.94 per 1,000 as against 3.08 per 1,000 in 1920.

BRITISH COLUMBIA

Silversmith Mines Co. Resumes Dividends—Divers Recover Gold in Placer Deposits near Quesnel

Sandon—The annual report to stockholders of the Silversmith Mines, Ltd., mailed with notices of the annual meeting of the company to be held here on Aug. 3, states that the surplus for the first five months of 1922, amounted to $65,891. During that period, the first part of which was devoted partly to getting the concentrator tuned up and zinc flotation equipment installed, 15,947 tons of ore was milled. Mill heads averaged 22.80 oz. silver; 9.14 per cent lead, and 8.26 per cent zinc. The concentrate production was 1,917 tons. Crude shipments for the five months totaled 373 tons, of which 116 tons was secured on the sorting belt, the balance being mine sorted. Development is reported as satisfactory. The first dividend paid by the company in two years was distributed the latter part of June.

Rossland—Another carload of high-grade gold ore has just been shipped by the lessees of the I. X. L. mine. It is believed that it will give even better returns than the two shipments made last winter. The ore was sent to the Bunker Hill smelter.

Windermere—Recent development on the Mineral King group on Toby Creek has opened shipping ore, and indicates the development of a large body of milling material. It is believed that sufficient of the former can be mined and shipped notwithstanding a 22-mile wagon haul to railway transportation, to pay for a mill to treat the latter. The property is owned by Victor Sontage and associates of Seattle.

Nelson—Sheriff's sale of the mining property of Gibson Mining Co., together with all equipment, including a three-quarter mile aerial tram, has been set for July 21, at the Nelson court house. The mining property consists of about seven mineral claims,

crown-granted, and is situated on Cariboo Creek, a tributary of the South Fork of Kaslo River. The ground is regarded as having prospective value, though the orebodies developed to date show much zinc associated with lead and silver. These present no serious milling difficulties under modern methods of concentration.

Grand Forks—An important new strike has been made by the Molly Gibson Burnt Basin Mining Co. at a depth of 75 ft. in its mine at Paulson. The orebody is 8 ft. wide, and the hanging wall has not yet been struck. The ore is heavily mineralized with chalcopyrite and carries some gold. Ed. Terzick, manager of the Molly Gibson mine, has commenced to develop the Enterprise group, in the same neighborhood.

Quesnel—A. Pierce, E. Gladwin, and J. Sackner, who left here for the Clearwater country, at the head of Quesnel Lake, six weeks ago, report the discovery of rich ground on Blue Lead Creek. Seven miles of the creek has been staked. Several promising strikes have been made on Spanish and Keithley creeks. At the junction of the Fraser and Chilcotin rivers something quite new in the way of placer mining is being done. Gold was found at this point early in the season, when the rivers were unusually low, and since the rivers have risen and it is no longer possible to reach the gold by ordinary methods, two gangs have been operating in diving suits, and are said to be making a good clean-up daily.

CALIFORNIA

Brunswick and Hughes Properties Near Grass Valley Are Reopened

Special Correspondence.

San Francisco—The Brunswick mine at Grass Valley, which has been closed for four years on account of the War, has been reopened by R. Chester Turner. A difficult unwatering problem confronts the management. The double-drum electric hoist used to unwater the Old Eureka mine at Sutter Creek has been purchased and will be used to unwater the Brunswick mine, which is 1,350 ft. deep. Mining was being conducted on eight levels prior to closing down. Two 20-stamp mills are available for ore reduction. Amalgamation and concentration will continue to be the method of treatment.

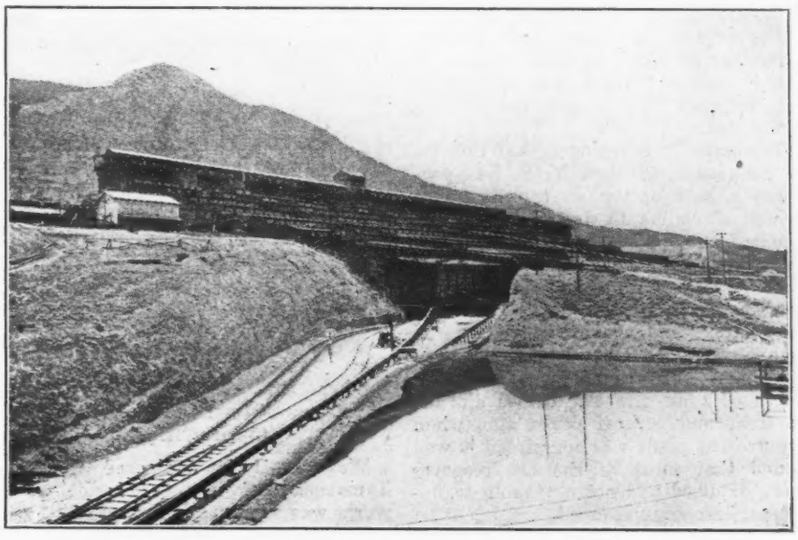
It is reported that the old Hughes ranch mine on Deer Creek northwest of Grass Valley, is to be re-opened. The vein has been developed by a tunnel driven into the hillside about 300 ft.

Preliminary estimates for the gold production of California for the six months ended June 30 indicate a slightly lower output than for 1921. With increased activity in gold mining the production for the remaining six months of 1922 should bring the total for the current year up to that of 1921 or slightly more. Silver production will be in excess of 1921; the production for the first six months of 1922 is approximately 250,000 oz. per month.

ARIZONA

Colorado Fuel & Iron Co. Will Develop Iron-Ore Deposit—Asbestos Properties Reported To Be Producing

Holbrook—The Colorado Fuel & Iron Co. is reported to be taking heavy drilling machinery into the country about midway between Pleasant Valley, in the northern Tonto Basin, and Cooley, the terminus of the 72-mile Apache railway that furnishes an outlet for the great Pollock lumber mill. Drilling is to demonstrate the extent and quality of an immense iron deposit near the head of Canyon creek. It is expected that the railroad will be extended from Cooley to the mines, about 30 miles, if development is satisfactory. Good lignite coal is available in nearby mines that have not been worked heretofore. Hydro-electric development is possible on a large scale on Salt river, less than 30 miles away. Iron production in Arizona would be a new industry. Within the state are many deposits of iron ore, but most of them are too high in their phosphorous content for utilization.



Nevada Consolidated concentrator at McGill, visited by serious fire. *See page 118.*

Globe—A new asbestos field is being opened on ridges that lead from both the Sierra Anchas and the Mogollons, where more than 200 claims are already staked. The principal holdings are those of the Triangle Asbestos Association, in which the principal members are H. S. Reid, of Chicago; W. H. Gregg, of Montana, and J. W. Fulton, a Pennsylvanian. Eighty acres of the Association's ground has been taken by Parvin, Richardson, Shive & Healey, of Los Angeles, who are preparing for shipment to independent consumers in the East. The fiber is found in several "layers," each of them several inches thick, lying one above the other and separated by a foot of gangue. It is readily mined through a comparatively soft formation.

A more expensive feature is the "cobbing," or cleaning of the asbestos from attached fragments of country rock. This is done very effectively by Apache Indians with the aid of light hammers, the aboriginal laborers averaging 100 lb. a day of clean material, for which they receive 4c. per lb. Then must come eight miles of mule transportation and 100 miles of trucking to Globe. The gross cost approximates $300 per ton, with a nominal market for No. 2 grade of $650 a ton; choicer grades bring above $1,000. The Pleasant Valley asbestos is notably high in quality, with less than a tenth of one per cent iron, making it peculiarly valuable for insulating uses. Its fiber is silky, capable of being spun readily and it is all the way from a half inch to even 4 in. in length.

Asbestos has been developed at many points along the northern boundary of Gila County, paralleling the great Rim of the Mogollon Plateau, and, as well, in the Sierra Ancha mountains, a geological extension of the Mogollons, though now separated by the broad valley of Cherry creek and a tangle of lower hills. The main trouble is the inaccessibility of the mines.

Though there has been a revival of work on the independent properties of the county, the bulk of the asbestos heretofore shipped has been from mines north of Globe owned by the Johns-Manville Co. or from the Raybestos property, controlled by similar interests, in the heart of the Sierra Ancha mountains, two miles from the county road at its Pocket creek crossing. Both of these larger mines have been idle for many months, in consequence of cheaper production and transportation of asbestos from the mines in Canada. There has been much secrecy concerning Arizona mines, from which, it is said, several millions of dollars worth of material has been shipped. The Raybestos property is well equipped.

NEVADA

Simon Silver-Lead Suspends Production Pending Completion of New Shaft and Changes in Flotation Plant—Eureka Palisade Railroad Is Sold

Eureka—The Eureka & Palisade narrow-gage railroad between Palisade and Eureka has been sold to a group of eastern capitalists said to be closely allied to the Eureka Croesus Mining Co. The sale price is not known but is thought to have been about $500,000.

The railroad has been controlled for a number of years by John Sexton of San Francisco. There was some friction between Sexton and the Mining companies.

Tonopah—It is reported that Charles A. Stoneham, of New York, has procured a new option on the Kanrohat group of claims in Jefferson Canyon, situated about 65 miles north of Tonopah, and is considering changing the present 150-ton flotation plant into a cyanide plant. The Kanrohat mine is an old one, and one on which a large amount of development work has been done, mostly by tunnel workings, to a depth of 1,500 ft. The ore is difficult to treat and several years ago, when the present plant was completed it was found that most of the ore reserves were oxidized and not amenable to flotation, and work stopped.

Mina—The Simon Silver-Lead Mines Co. has concluded to shut down its flotation plant for a period of five or six months. During the shutdown changes will be made in the mill that will increase the capacity from 180 to 250 tons per day. The immediate reason for discontinuing production, however, is to concentrate energy on the completion of the recently started three-compartment shaft. The old shaft has proved wholly inadequate even for the present tonnage. Financial arrangements to complete the new work have been made.

Pioche—The Silverhorn district is being developed and machinery has recently been installed on the Silver Dale mine; underground work has been retarded in the past by lack of machines, as the ground is too hard for progress with hand drilling. About thirty men are now working on the various properties, which include the Nevada Silverhorn, the Silver Dale, the Silver Dale Extension, the Silver Peer, the Silver May, and the Silverhorn Extension. A number of these properties were sold this spring for substantial considerations.

Owing to a car shortage no shipments have as yet gone forward from the tailings piles at Bullionville, 400 tons is in stockpiles awaiting shipment. Tonnage shipped from the Pioche district during the past two weeks was as follows: Bristol Silver Mines, 460 tons, Black Metals mine, 175, Mendha mine, 100, Prince Consolidated Mining Co., 50, Silver Dale Mining Co., 30, and the Stella Mines at Comet, 40, a total of 855 tons.

WASHINGTON

Iron Creek Mining Co. Will Deepen Shaft

Springdale—The Santa Rita Mining Co., which is operating the old Cleveland mine and mill, is maintaining regular shipments to the Bunker Hill smelter.

Keller—New mechanical equipment has been acquired lately by the Iron Creek Mining Co., including new drills, an air receiver, and a pump; this will make it possible to operate the mine with machine drills. Immediate plans of development include sinking an additional depth of 200 ft.

COLORADO

Smuggler Union and Tomboy Companies Both Ship Concentrate

Telluride—Shipments of concentrate from the Telluride district for the month of June were as follows: Smuggler-Union, 82 cars; Tomboy, 55 cars; total, 137 cars. Shipments for same month last year 133 cars.

IDAHO

Bunker Hill Smelter Starts Second Furnace—Miners Are Needed In Coeur d'Alenes

Wallace—It is estimated that the Tamarack and Hercules mines where work was recently resumed will give employment to between 500 and 600 men. As a consequence of resumption there is now an actual shortage of labor in the Coeur d'Alene district. There was no surplus labor before these mines resumed, and for the past year the central employment office for the mines in Wallace has been continuously advertising for miners in various labor centers of the west. The situation is made even more acute through a resumption of many small development companies and the performance of annual assessment work, many miners preferring this class of work to employment in the large mines. Miners receive $4.25 per day and muckers $4.

According to a statement by Frank M. Smith, director, the Bunker Hill smelter at Kellogg will blow in another furnace about July 15. Only one is being operated now. This is made necessary on account of increased shipments both from points within the Coeur d'Alene district, and also from mines in Oregon, Washington and British Columbia. Shipments for June included 136 tons from the Gladstone, 200 tons from the Electric Point, and a car of 27 tons from the Lead Trust mine, all in Stevens county, Washington. Two cars came from the Santa Rita Mining Co., which is operating the old Cleveland mine near Springdale and the Pyragyrite Mining Co. also shipped two cars. From the Bayhorse mine in Oregon nearly a car a day of a silicious silver ore is coming. In the Coeur d'Alenes, the Western Union shipped 300 tons, the Sunshine 100 tons and a number of other properties a total of 200 tons.

UTAH

Vipont Silver Mining Co. Is Producing 225 Tons of Ore Daily—New Tunnel Nearing Completion

By Our Special Correspondent.

Eureka—Tintic shipments for the week ended July 1 amounted to 143 cars. Shippers were: Chief Consolidated, 45 cars; Tintic Standard, 38; Iron Blossom, 12; Grand Central, 11; Colorado, 8; Eagle and Blue Bell, 8; Victoria, 6; Swansea, 5; Gemini, 4; Centennial-Eureka, 2; Mammoth, 2; Tintic Drain Tunnel, 1; Sioux Consolidated, 1; The Victoria mine, which, like the adjoining Eagle & Blue Bell, is controlled by the Bingham Mines Co. is being opened to lessees as far as the 1,700 ft. level. At the Gemini, an option for the leasing of the ground below the water level given Salt Lake men, has been allowed to lapse. The ground in question will be drained by the company, and let under the individual leasing system. The recent strike at the Bullion Beck is reported to be developing satisfactorily. A strike at the Iron King is reported.

Park City—Shipments for the week ended July 1 amount to 5,209 tons. The Ontario, which heads the list of shippers is shipping largely from its tailings dump. Shipments are as follows. Ontario, 2,753 tons; Silver King Coalition, 986; Park-Utah, 822; Judge, Daly, and Daly West, 649 tons.

A scarcity of competent miners is still evident, but this may be relieved somewhat when assessment work is completed.

Park-Utah stock has been listed on the New York stock exchange, trading to start July 13. New ore has been opened at this property along what is thought to be a fissure parallel to the thus far main productive fissure. In the latter, which has been furnishing the shipments, an oreshoot has been followed for more than 800 ft. along the strike and for 200 ft. on the dip. A crosscut run through the footwall of this fissure opened the new ore above mentioned, which is of similar grade (40 to 50 oz. silver) to that in the main orebody. Another crosscut into the hanging wall driven to obtain waste for stope filling, has cut 50 ft. of 20-oz. ore, which is thought to be a part of the main body, and which is being put into the chutes. Only a small part of this company's holdings is developed.

Vipont—The drainage and transportation tunnel of the Vipont Silver company, whose property is 26 miles from Oakley, Idaho, the nearest shipping point, has attained a length of 2,000 ft. and is expected to be completed by Aug. 1. The main shaft, which goes to a depth of 600 ft. on the incline and 250 ft. vertically, has reached a point below the tunnel level, on which connections will be made with it. This shaft, which has produced about half of the tonnage from the mine, will be continued to greater depth. The mill is treating an average of 225 tons of ore daily, and it is expected soon to increase the capacity to 300 tons.

MONTANA

Butte-Duluth and Bullwhacker Properties Consolidated—Operations To Be Resumed

Butte—With the announcement of the consolidation of the Butte-Duluth and Bullwhacker properties to be operated by the Consolidated Metals Co., Butte mining circles are expecting early resumption at these two old producers. Headed by James T. Finlen, vice president of the Metals bank, James H. Rowe, and Al Frank, it is expected that the new company will begin operations immediately. It is announced that about 400 men will be employed as soon as the mines can be put in shape for taking out ore. Both properties have been closed down for the last two years, the Butte-Duluth having been in the hands of a receiver. The new company has acquired control through purchase of the bonds.

Lightning striking the shaft of Anaconda's Silver Bow mine on July 4 damaged the gallows frame and a portion of the shaft timbering. The mine has not been operating for nearly two years but has been used for development work.

Extensive operations have been started on a number of mining claims immediately west of Butte following the discovery of a rich pocket of silver ore in the Munsey claim of the West Side Silver Mining Co. This section is known to have considerable silver, and rich rock has been taken from other properties in the vicinity including the Hibernia of the Davis-Daly company. An assay from the pocket found in the Munsey showed silver running $4,000, gold $96, and copper 5 per cent. The owners of other properties immediately started work after long idleness.

The discovery of a body of molybdenum ore on Parmenter creek near Libby, Mont., is reported. Analysis of two samples of the ore showed values running around $80 per ton. The discovery was made on the Bryant claim.

MICHIGAN

The Copper Country

Arcadian Resumes Sinking New Baltic Shaft—Copper Shipments in June Totaled 10,336,000 Lb.

Houghton—June copper shipments from the smelters of the Lake district were fully up to expectations. A total of 10,336,000 lb. was shipped, as follows: 5,204,000 lb. from the Calumet & Hecla docks, largely C. & H. and Ahmeek metal; 3,300,000 lb. from the Michigan smelter, made up of Copper Range, Mohawk, and Wolverine copper; 1,294,000 lb. from the Quincy smelter; and 538,000 lb. from the Dollar Bay docks. Shipments for the month were somewhat larger than in May, when 10,008,000 lb. were moved. Approximately twice as much metal is being shipped as a year ago, the 1921 June shipments being only 5,858,000 lb.

Arcadian has resumed sinking in its New Baltic shaft, which will be lowered 150 ft. from the 1,100 level. Preparations have been made to speed up the work, which, it is expected, will be finished within two months. The shaft will be timbered, laddered, and piped and the skipway built as it is sunk, which is somewhat of an innovation in this district, and the station also cut before the 1,250 level is reached. By Sept. 1 the shaft should be in readiness for drifting both north and south.

Work on the 942-level drift, south, will continue for the management desires to connect this opening with a north drift from the 900 level of the New Arcadian shaft as soon as possible.

Good progress is being made at Seneca both underground and with the construction program on surface. As soon as the boilers and new hoist are installed at Gratiot No. 2 shaft, a railroad connection will be established. Seneca's north drifts toward No. 2 continue in good ground.

Gogebic Range

Jones & Laughlin Co. Starts Prospecting On Eastern End of Range

Ironwood—Exploration of the eastern end of the range has been resumed by the Jones & Laughlin Co. It has let a contract to the S. E. Atkins Co. of Duluth for diamond drilling on Sec. 8, T 47 N, R 45 W. This is at the western end of Sunday Lake and north of the Wakefield open-pit mine. The work will be directed by James Trebilcock, of Ishpeming. The Jones & Laughlin Co. is a new entrant in the Gogebic district. A few years ago it did some diamond drilling in the formation east of where the Morgan mine is now located in Sec. 11, T 47 N, R 45 W, and found a body of bessemer ore, probably the larger end of the Morgan orebody. It did not, however, develop it. This new move indicates that it is planning to acquire further ore reserves in this district.

So far the strike of the railway shopmen has not caused any shortage in the car service to the mines, and the operators do not appear to be worried about the future. Some shopmen have come in from the Chicago district.

The scale of wages prevalent at the underground mines on the Gogebic and other Lake Superior iron ranges is as follows.

Underground Labor, 8-Hr. Shift.	
Miners, company account	$3.72
Miners, contract	about 4.06
Timbermen, fixers	$3.28–3.48
Motormen, swampers, chutemen, skip tenders, and trackmen	3.36
Pipemen	3.15
General labor	3.00
Shift bosses	about 4.40
Surface Labor, 10-Hr. Shift.	
Landers	3.00
Motormen	3.30
General labor, timber framers	3.00
Carpenters	3.80
Carpenter's helpers	3.35
Machinists, blacksmiths	3.35–3.65
Machinists, blacksmith's helpers	3.05
Hoisting engineers	3.40–3.78

MINNESOTA

Mesabi Range

Mesabi Iron Co. Is Shipping Sinter Regularly—Six Shovels in Ore in Missabe Mountain Pit

Virginia—The Pilot mine, operated by the M. A. Hanna Ore Co., has been placed on a double-shift basis. This property has been stripped and the ore is being mined by the milling system.

The Oliver Iron Mining Co. is working its large Missabe Mountain open pit to full capacity with six steam shovels digging ore, and one shovel on clean-up work. It is anticipated that 3,000,000 tons of ore will be shipped from this pit this season.

Hibbing—The Tod Stambaugh Co. has increased its shipments from this district by consignments from the Warren open pit and from the stockpile at the Morton mine. Shipments from the stockpile of the Stevenson mine, operated by the McKinney Steel Co., are also being sent daily to the docks.

Babbitt—Operations at the plant of the Mesabi Iron Co., are progressing more rapidly each week and shipments of the sinter product are being sent to the docks. A broken shaft of one of the jaw-crushers delayed crushing for several days but operations have again been resumed. The work in the open cuts is proving more satisfactory and a large tonnage of ore is now being blasted and handled in fine shape.

Cuyuna Range

Ironton—Electric pumps have been started at the Huntington mine to unwater the workings preparatory to resumption of mining. This property, operated by the Whitmarsh Mining Co., has been idle since early in 1919. A shaft was first put down at the Huntington in 1918 and during the following winter about 25,000 tons of ore was mined. This ore has recently been shipped from stockpile. The property will be operated by underground methods for the present, although plans are being considered for open-pit operation.

The Pennington mine (Tod-Stambaugh Co.) began shipments early in July, after a long period of idleness. Some ore will be mined from the Armour No. 1 mine through the Pennington pit this season, as has been done in the past.

The Armour No. 2 mine of the Inland Steel Co. has completed shipments of approximately 150,000 tons from stockpile.

The Hillcrest Mining Co. is widening and relocating the approach to its Hillcrest open pit mine to release some ore covered by the old approach.

Crosby—Shipments have been begun from the Meacham mine stockpile by the Rogers-Brown Ore Co. The property, an underground iron mine, is still idle.

Cuyuna—The Rogers-Brown Ore Co. has placed a second diamond drill upon exploration of the new ore found to the east of the Kennedy shaft. The Kennedy is now shipping steadily from both stockpile and shaft pocket.

THE MARKET REPORT

Daily Prices of Metals

July	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
6	13.625	30.75	31.375	5.75	5.50	5.425
7	13.625	30.625	31.375	5.65@5.75	5.475@5.50	5.45
8	13.625@13.75	30.625	31.375	5.70@5.75	5.475@5.50	5.45
10	13.625@13.75	30.625	31.375	5.75	5.475@5.50	5.475
11	13.625@13.75	30.50	31.25	5.75	5.475 5.50	5.475
12	13.625@13.75	30.50	31.20	5.75	5.45 @ 5.50	5.475@5.50

*These prices correspond to the following quotations for copper delivered: July 6 and 7, 13.875c.; 8, 9, 10 and 11, 13.875@ 14c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

July	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
6	62⅜	62⅞	70	153⅞	154⅝	24¼	23⅜	28	27¾
7	63	63⅜	70	154¼	155	24¼	23⅜	28⅛	27⅞
10	62⅞	63⅜	70¼	154½	155¼	24¼	23⅜	28¼	28
11	63	63⅜	70¼	153½	154½	24⅛	23¼	28⅜	28⅛
12	63¼	63⅝	70¼	153⅜	154¼	24¼	23⅜	28¼	28⅛

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

July	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	July	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
6	444¾	99⅛	71	35⅞	10	444¼	99⅜	70¾	35⅞
7	444½	99⅜	71⅛	36	11	443¾	99⅜	70⅝	35⅞
8	444	99⅛	71⅛	36¼	12	443⅜	99⅛	70	35⅝

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

Metal Markets

New York, July 12, 1922

The week's activity in the major metal market was characterized by both advances and declines in the metals, copper and zinc showing strength and tin and lead softness. The strike situation, in coal and on the railroads, is still held to be responsible for the failure of some consumers to place their orders and so aid the metal market. Industrial conditions in the United States are otherwise generally believed to be favorable, probably better than many people realize.

Copper

Business in copper has been heavier than that of last week, both in the domestic and foreign market. Early in the week copper was freely sold for 13.875c., delivered, for near-by shipment by many producers, although 14c. was asked occasionally. One small sale was made at 13.75c. delivered. The market gradually hardened so that today but a small amount of copper is offered below 14c., which is the general asking and selling level for metal for early delivery. Copper for delivery as far ahead as October and November has been sold at prices equivalent to the spot market. Several large-sized orders—that is, over 500 tons each—were reported sold in the domestic market. In general, inquiries have been for moderate tonnages, probably indicating that much hand-to-mouth business is still being done. Although consumption of copper is progressing at a good rate, and the statistical position of the metal is greatly improved over that of last year, consumers are in one or two instances unsatisfied with retail absorption of the metal. Cable business is reported as being unsatisfactory, a condition that is due partly to the seasonal nature of the business.

Foreign trade in copper is better. The prices which producers have netted have been closer to the domestic price than for many weeks, and have netted them about 13.80c., f.o.b. refinery. This is attributable to the intensity of competition for European business. Germany, France, and England are still purchasing the metal. Germany, despite the condition of its currency, manages to obtain the metal when it wishes it.

Lead

The official contract price of the American Smelting & Refining Co. continues at 5.75c., New York.

A fair business in lead has been done during the week, and of the total it is estimated that about three-quarters was transacted in the New York market for shipment between Boston and Philadelphia as extreme points. Last Thursday the market in the East was 5.75c and in St. Louis, 5.50c., but the following day several hundred tons were sold at 5.65c., although other sales were made at 5.75c. which has been the general selling price during the week. One or two small lots were sold at 5.70c., New York. The bulk of the Western business reported was done on a 5.50c. basis, with some dealers making concessions of 2½ points. Although reports are current in the trade of sales in the Middle West at 4.40c., we have been unable definitely to confirm transactions at this quotation.

An important change in selling agencies was made public yesterday. The St. Joseph Lead Co. has entered into a contract with the Bunker Hill & Sullivan Mining & Concentrating Co. whereby the St. Joseph Lead Co. has agreed to buy the entire output of the Bunker Hill & Sullivan for five years beginning Sept. 1 next on an average price basis, excepting such lead as the Idaho company may wish to sell in the western part of the United States, Canada, and South America. Bunker Hill lead has been sold by the American Metal Co. This change adds greatly

to the amount of metal the St. Joseph Lead Co. will have to sell and widens the variety of lead at its disposal.

Zinc

Trading has been dull, with some producers entirely out of the market. The fact that dealers have not pressed their metal for sale has probably had something to do with the improvement in price which has carried the metal from 5.40c. to 5.50c., the general selling price today. Forward zinc commands a premium of 2½ to 5 points for late August or September shipment. High-grade business was done during the week at 6¼c. per lb., with the usuai freight allowance of 30c. per 100 lb.

Tin

The market remains exceedingly quiet. Yesterday the total business in the New York market was reported as fifty tons. Earlier in the week an effort was made by dealers to trade with each other to stimulate interest in the market. However, the failure of support from London made this a short-lived attempt.

Arrivals of tin in long tons: July 3, Straits, 1,010; 5th, Straits, 175; Batavia, 125; 6th, Great Britain, 60; 7th, China, 100; 10th, Straits, 250, Liverpool, 5; 11th, Straits, 600.

Gold

Gold in London: July 6, 92s. 5d.; 7th, 93s.; 10th, 92s. 10d.; 11th, 92s. 10d.; 12th, 93s.

Foreign Exchange

Movements in foreign exchange have been variable. Monday and Tuesday rates moved to a higher level, which was attributed to a better sentiment abroad regarding reparations. On Tuesday, July 11, francs were 8.06c.; lire, 4.49c.; marks, 0.2047c.; and Canadian exchange 1⅛ per cent discount.

Silver

China has sold in London during the last week, and has refrained from buying for San Francico delivery, except to a limited extent, and then only at prices close to the New York level. This has resulted in a quiet market, with a downward tendency.

Mexican Dollars—July 6th, 54¼; 7th, 54⅜; 8th, 54½; 10th, 54⅜; 11th, 54; 12th, 53½.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—20.10c. per lb. for 99 per cent grade; 19.10c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17.75@18.25c. for 98@99 per cent virgin grades.

Antimony — Chinese and Japanese brands, weak at 4.95@5c. W.C.C., 5.75c. Cookson's "C" grade, 7@7.50c.

Bismuth—$2@$2.10 per lb.

Cadmium—$1.20@$1.25 per lb.

Iridium—$170@$175 per oz.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market, 31@33c. per lb.

Palladium—$55@$60 per oz.

Platinum—$90 per oz. Better demand.

Quicksilver—$55 per 75-lb. flask. San Francisco wires $54.30. Quiet.

Selenium—$1.75@$1.85 per lb.

The prices of **Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, Thallium** and **Tungsten** are unchanged from prices given July 8.

Metallic Ores

Manganese Ore—28c. per long ton unit, seaport. Small quantities only available for early delivery.

Iron Ore, Chrome, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, and Zircon ore are unchanged from the quotations published July 8.

Zinc and Lead Ore Markets

Joplin, Mo., July 8.—Zinc blende, per ton, high, $35.25; basis 60 per cent zinc, premium, $34@$35; Prime Western, $33@$35; fines and slimes, $32@$31; average settling price, all grades of blende, $33.86; calamine, basis 40 per cent zinc, $18.

Lead, high, $83.15; basis 80 per cent lead, $77@$75; average settling price, all grades of lead, $79.79 per ton.

Buyers report the $35 basis paid for blende was for ore with an excess iron content. Sellers held firm and buying was less, but around 1,000 tons in excess of the production. Monday and Tuesday the mines were not operating, and many were short-handed on Wednesday, restricting the output about 4,000 tons.

Demand for lead has declined and prices were lowered $5 per ton on most ore bought for next week's delivery.

Platteville, Wis., July 8.—Blende, basis 60 per cent zinc, $34 per ton. Lead ore, basis 80 per cent lead, $78 per ton. Shipments for the week: Blende, 193 tons; lead ore, none. Shipments for the year: Blende, 8,227 tons; lead ore, 1,014 tons. Shipments during the week to separating plants, 622 tons.

Non-Metallic Minerals

Barytes—Washed crude, 92 per cent $BaSo_4$ guaranteed, $8 to $9 per long ton f.o.b. Georgia points; off color ground No. 1 grade $20, No. 2 grade, $15.

Feldspar—No. 1 pottery grade active at $6.50 per ton, North Carolina. Pottery grade in Maine, $18; No. 2 ground to 90 to 100 mesh, $10; No. 1 ground to 140 mesh, $16, f.o.b. mills, N. C.

Talc—200 to 300 mesh, including containers, $13.50@$14.75 f.o.b. New York state mills. In California, 200 mesh, $16@$18 per short ton; 300 mesh, $25@$30, bags extra at cost.

Asbestos, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, and Sulphur are unchanged from the prices published July 8.

Mineral Products

Arsenious Oxide (white arsenic)—7.50c. per lb.

Potassium Sulphate and **Sodium Sulphate** are unchanged from quotations of July 8.

Copper Sulphate—Large crystals, 6.50c. per lb. Spot market strong.

Sodium Nitrate—$2.25@$2.65 per 100 lb., ex vessel Atlantic ports.

Ferro-Alloys

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium, and Ferrovanadium are unchanged from the prices published July 8.

Metal Products

Copper Sheets—New York base, 21c. per lb.; wire, 16@16.25c.

Nickel Silver—27.5c. per lb., for 18 per cent nickel Grade "A" sheets.

Yellow Metal—Dimension sheets, 18.25c.; rods, 15.25c. per lb.

Lead Sheets and **Zinc Sheets** are unchanged from the quotations published in the July 8 issue.

Refractories

Magnesite Brick—$56 per net ton.

Magnesite Cement — $35@$40 per ton.

Silica Brick—$33@$41 per 1,000, f.o.b. shipping points.

Bauxite Brick, Chrome Brick, Chrome Cement, Firebrick, and **Zirkite** are unchanged from the prices appearing in the issue of July 8.

The Iron Trade

Pittsburgh, July 11, 1922

Production of steel ingots in June was at the rate of about 36,600,000 tons a year, showing just a perceptible increase over the May rate. Production increased very rapidly early in the year, the rate of increase gradually tapering off.

The Steel Corporation's unfilled obligations increased by 602,769 tons in April, 157,311 tons in May and 381,403 tons in June, to a total of 5,635,631 tons, equal to 5½ months of production at the present rate of shipping, about 75 per cent. An unusually large proportion, probably more than two-thirds, of the corporation's obligations are in the form of actual shipping orders, for shipment at mill convenience. A year ago the condition was altogether different, for with almost as large an unfilled tonnage reported the corporation operated at only 25 per cent in July.

Pig Iron—There is increasing remark about the ability of consumers to stay out of the pig iron market. Prices remain quotable as formerly, $25 for bessemer and basic and $24 for foundry, f.o.b. Valley furnaces, freight to Pittsburgh being now $1.76. It is possible these prices could be shaded on a firm bid.

Coke

Connellsville Coke—The limited offerings are at about $9, which does not interest furnaces, the coke going to miscellaneous consumers. More interest is being taken in West Virginia and Alabama coke.

COMPANY REPORTS

Howe Sound Co.

Copper; British Columbia Lead, Silver; Mexico

A report of operations of the Howe Sound Co. for 1921 shows a profit of $288,044.40 according to the following profit and loss account:

Mining	$485,169.46	
Transportation (from mine ore bins to smelter)	99,069.12	
Smelting and marketing (Including Mexican export duty)	869,001.74	
Extraordinary (Due to Britannia flood)	41,233.47	
Administration (Including general and legal expenses, etc.)	81,359.29	
Taxes	69,671.17	
Balance	1,106,938.29	
	$2,752,442.54	
Smelter returns, silver, 2,961,773 oz., lead 20,430,673 lb	$2,399,337.13	
Miscellaneous income	353,105.41	
	$2,752,442.54	
Depreciation and depletion	$639,333.89	
Interest	179,560.00	
Balance	288,044.40	
	$1,106,938.29	
Balance, as above	$1,106,938.29	

The balance sheet of the company as of Dec. 31, 1921, follows in detail:

ASSETS		
Fixed		
Mining property	$8,222,422.08	
Plant, buildings and machinery	4,071,780.97	
Investments	1,124,473.81	
		$13,418,676.86
Deferred charges		266,003.76
Reserve fund		195,302.02
Current: Inventories, accounts receivable U. S., Dominion of Canada, and other bonds etc		3,608,604.45
		$17,488,587.09
LIABILITIES		
Capital stock		$1,984,150.00
Authorized issue, 3,000,000 shares, par value, $1, of which 1,984,150 shares have been issued		
Twenty-year 6 per cent gold bonds (Due Jan. 1936)		3,766,000.00
Outstanding Dec. 31, 1920	$4,035,000.00	
Redeemed Oct., 1921	269,000.00	
Reserves		8,364,031.11
Depreciation and depletion	7,831,039.41	
Insurance	517,005.43	
Workmen's compensation, etc	15,986.27	
Profit and loss		3,221,349.42
Balance as at Dec. 31, 1920	2,933,305.02	
Profit for 1921, per Profit and Loss account	288,044.40	
Current liabilities: Accounts payable, including payrolls, etc		153,056.56
		$17,488,587.09

During the year the Howe Sound Co. acquired the remaining outstanding shares of the Calera Mining Co. and now owns its entire capital stock. In addition, the Howe Sound Co. owns all of the outstanding shares of Britannia Mining & Smelting Co., Ltd., and 53,800 shares of the 60,000 issued and outstanding shares of El Potosi Mining Co.

Ore broken during the year amounted to 46,443 tons at Britannia. Broken ore reserve Dec. 31, 1921, was 1,686,214 tons compared with 1,687,156 tons on Dec. 31, 1920. Average copper content is 2.8 per cent. Reserves in place amount to 5,095,910 tons averaging 1.9 per cent copper.

At El Potosi 146,282 dry tons were mined and shipped of which 100,482 tons was lead carbonates containing 16.33 oz. silver and 9.09 per cent lead per ton and 45,800 tons lead sulphides averaging 28.84 oz. silver and 2.36 per cent lead.

Owing to the continuance of low selling price for copper, production from the mines of the Britannia company was not resumed.

Greene Cananea Copper Co.

Copper; Mexico

A report of operations of the Greene Cananea Copper Co. for 1921 shows a loss of $2,468,091.44, according to the following income account:

INCOME		
Sales of metals		$4,134,872.25
Miscellaneous receipts		39,224.65
		$4,174,096.90
EXPENSES		
Mining	$154,311.18	
Reduction	109,374.11	
Refining and selling	87,308.10	
Administration and taxes	250,393.13	
Metals in process and on hand at beginning of year	6,979,941.25	
	$7,581,327.77	
Metals in process and on hand at end of year	1,451,844.91	$6,129,482.86
		$1,955,385.96
Expenditures on buildings and equipment written off		15,879.55
Interest paid		3,736.77
Operating loss		$1,975,002.28
Expenditure during suspension of operations		493,089.16
Balance—Net loss for year		$2,468,091.44

Balance sheet as of Dec. 31, 1921, follows:

ASSETS		
Fixed		
Mines and mining claims, lands, railways, buildings and equipment	$51,557,700.60	
	68,601.00	
		$51,626,301.60
Current		
Supplies and prepaid expenses	$1,230,503.82	
Metals in process and on hand—at the lower of cost or market	1,451,844.91	
Accounts receivable	433,103.80	
Cash and cash assets	1,282,908.09	$4,398,360.62
		$56,024,662.22
LIABILITIES		
Capital stock		
Authorized—600,000 shares of $100 each		
Issued—500,000 shares		$50,000,000.00
Reserves		
For depreciation	$528,733.88	
Mexican legal reserve	4,000.00	
		532,733.88
Current		
Accounts and wages payable and taxes accrued		62,631.96
Surplus		
Balance Dec. 31, 1920	$7,897,387.82	
Net loss—year ended Dec. 31, 1921	2,468,091.44	5,429,296.38
		$56,024,662.22

Tonopah Belmont Development Co.

A condensed statement of operations of the Tonopah Belmont Development Co. for the quarter ended March 31, 1922, follows:

Received and receivable for ore	$487,429.48
Mining, milling and administration expenses	368,577.96
Net earnings for three months	$118,851.52
Miscellaneous income	5,078.55
Total net income for three months ended March 31, 1922	$123,930.07

Available resources, May 31, 1922, were:

Due from smelter	$285,186.44
Due from others	50,068.44
Cash in banks	226,029.65
U. S. Government Certificate of Indebtedness	100,000.00
Liberty bonds	50,220.14
	$711,504.67

The net earnings for the quarter ended March 31, 1922, of the Belmont Surf Inlet Mines, Ltd., of which this company owns 80 per cent, were $18,804.66.

International Nickel Co.

A report of operations of International Nickel Co. for year ended March 31, 1922, shows a loss for the year of $797,746.93 according to the following profit and loss statement:

Earnings of all properties after deducting manufacturing, selling expense, ordinary repairs and maintenance		$373,085.85
Other income		234,267.45
Total income		$607,353.30
Deduct		
General office expense	$442,074.93	
Reserved for federal and franchise taxes (estimated provision)	81,674.03	
		523,748.96
Net operating income		$83,604.34
Deduct		
Shut-down expense	$428,630.70	
Depreciation and depletion (provision for)	437,720.57	
Foreign companies not included	15,000.00	
		881,351.27
Loss for year		$797,746.93
Surplus, April 1, 1921		$11,886,177.21
Loss for year as above	$797,746.93	
Adjustment of inventories, etc. (net)	537,833.89	
Dividends preferred	534,756.00	
		1,870,336.82
Surplus, March 31, 1922		$10,015,840.39

Consolidated general balance sheet as of March 31, 1922, follows:

ASSETS		1922	1921
Property account:			
Including investments in stocks of Nickel Corporation, Ltd., and Société Minière Calédonienne as at March 31, 1921		$58,321,527.39	$57,118,017.59
Less written off for dismantlement		286,575.48	111,100.70
		$58,034,951.91	$57,006,916.89
Expenditures for additional property, construction and equipment, less recoveries		2,471,863.60	1,314,610.50
		$60,506,815.51	$58,321,527.39
Deduct:			
Reserves			
Depreciation	$8,649,169.81		$8,519,150.82
Depletion	2,096,590.86		2,075,464.76
		10,745,760.67	$10,594,615.58
		$49,761,054.84	$47,726,911.81
Investments:			
Real estate mortgage and sundry securities		558,485.13	566,580.64
Advanced to Nickel Corporation, Ltd., and Société Minière Calédonienne	5,737.78		9,556.18
Less—Reserve to cover operations	5,737.78		9,556.18
		$50,319,539.97	$48,293,492.45
Current assets		$12,131,411.76	$16,645,212.00
		$62,450,951.73	$64,938,704.45

LIABILITIES		1922	1921
Capital Stock	Authorized	Issued	
Preferred 6% non-cumulative	$12,000,000.00	$8,912,600.00	$8,912,600.00
Common	50,000,000.00	41,834,600.00	41,834,600.00
	$62,000,000.00	$50,747,200.00	$50,747,200.00
Current Liabilities			
Accounts payable and pay rolls	$494,845.68		$504,736.45
Taxes accrued	193,811.20		386,997.95
Dividends unclaimed	152.91		212.91
Preferred stock dividend No. 66 Payable May 1, 1922	133,689.00		133,689.00
		822,498.79	$1,025,636.31
Funds and Reserves			
Accident, insurance and contingent		865,412.55	1,279,690.93
Surplus			
March 31, 1922		10,015,840.39	11,886,177.21
		$62,450,951.73	$64,938,704.45

The general depression existing in the metal industry since 1920 became more acute during the twelve months covered by this report and seriously affected the company's business. The demand for its products decreased to such an extent that the total sales were less than during any similar period since 1904. Nickel sales fell off 60 per cent from the previous year and Monel metal sales, though relatively better, decreased 33 per cent. This condition called for drastic curtailment and economies.

Movements of Ores and Metals

Imports and exports of certain metals and ores during May, 1922, as reported to the Department of Commerce, and the comparative figures for May, 1921, as finally revised, are as follows:

IMPORTS, MAY,

(In pounds, unless otherwise stated)

	1921	1922
Antimony ore, contents	.....	.....
Antimony matte, regulus or metal	891,180	1,057,596
Copper:		
Ore, contents	1,153,410	6,214,750
Concentrates, contents	1,102,147	6,807
Matte, regulus, etc., contents	817,150	49,065
Imported from (in part):		
Spain	164,880	261,340
Canada	991,900	75,833
Mexico	511,633	75,340
Chile	.....	4,227,714
Peru	501,897	10,520
Unrefined, black, blister, etc	5,171,662	9,700,997
Refined, in bars, plates, etc	7,400,392	10,931,280
Old, etc., for remanufacture	58,321	429,935
Composition metal, copper chief value	58,421	115
Lead:		
Ore, contents	1,209,508	1,250,028
Bullion, contents	8,466,192	8,216,290
Imported from (in part):		
Canada	208,170	625,635
Mexico	8,713,712	8,657,276
Chile	.....	38,062
Pigs, bars and old	23,482,927	1,127,419
Manganese ore, long tons	54,663	46,517
Imported from (in part):		
Cuba, long tons	.....	.....
Brazil, long tons	26,849	34,400
British India, long tons	21,300	6,500
Tungsten ore, long tons	370	80
Pyrites, long tons	19,143	5,323
Imported from:		
Spain, long tons	19,139	5,323
Canada, long tons	.....	.....
Tin ore, long tons	425	1,604
Tin bars, blocks, pigs, etc	2,021,762	8,489,881
Imported from (in part):		
United Kingdom	828,941	1,485,458
British Straits Settlements	1,078,409	6,332,642
Dutch East Indies	.....	626,985
Hong Kong	43,842	33,596
China	.....	11,200
Zinc:		
Ore, contents	50,820	11,279
Imported from:		
Mexico	50,820	.....
Canada	.....	.....
Blocks, or pigs, and old	.....	32,861

EXPORTS OF COPPER, LEAD AND ZINC

(In pounds)

	1921	1922
Copper:		
Ore, contents, concentrates, contents	.....	758
Unrefined, black, blister, etc	11,138	.....
Refined, in ingots, bars, etc	32,259,011	58,085,033
Exported to:		
Belgium	1,188,531	2,113,452
France	4,454,538	10,889,698
Germany	7,073,597	20,349,878
Italy	2,345,608	3,598,061
Netherlands	2,623,529	1,815,775
Spain	880,814	513,025
Sweden	812,587	2,691,185
United Kingdom	6,765,201	3,709,788
Canada	354,322	16,420
Japan	560,000	1,970,995
Other countries	5,200,284	10,416,756
Composition metal, copper chief value	2,100	25,125
Old and scrap	2,960	246,150
Pipes and tubes	120,834	139,155
Plates and sheets	275,695	486,720
Wire, except insulated	2,706,213	884,774
Lead:		
Pigs, bars, etc.:		
Produced from domestic ore	119,700	1,274,881
Produced from foreign ore	505,375	2,243,122
Exported to (in part):		
France	.....	1,118,917
United Kingdom	.....	672,897
Canada	50,626	205,007
Argentina	.....	571,213
China	.....	128
Brazil	.....	224,028
Zinc:		
Dross	.....	1,799,248
Spelter:		
Produced from domestic ore	135,365	10,234,772
Produced from foreign ore	.....	560,000
Exported to (in part):		
France	.....	1,747,253
Italy	.....	448,000
United Kingdom	.....	394,908
Canada	.....	226,050
Mexico	.....	61,136
Argentina	.....	11,200
Japan	112,013	7,278,589
Other countries	23,352	627,636
In sheets, strips, etc	214,747	1,309,523

MINING STOCKS

Week Ended July 8, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	64	61	64	Sept. '20, Q	$0.50
Alaska-Br. Col. new.	N. Y. Curb	3¼	2⅞	3		
Allouez	Boston	26	24	25½	Mar. '19	1.00
Anaconda	New York	53¾	51	52⅝	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3¾	3½	3¾		
Ariz. Com'l	Boston	9¼	9⅛	9¼	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*18	*12	*14		
Bingham Mines	Boston	†15½	†15	15¼	Sept. '19, Q	0.25
Calumet & Arizona	Boston	62½	59	61¾	June '22, Q	0.50
Calumet & Hecla	Boston	275	270	275	June '20, Q	5.00
Canada Copper	N. Y. Curb	*34	*22	*22		
Centennial	Boston	11	10	11	Dec. '18, SA	1.00
Cerro de Pasco	New York	37⅜	35¼	36¼	Mar. '21, Q	0.50
Chile Copper	New York	23¼	20⅞	22¼		
Chino	New York	30¼	28¼	29½	Sept. '20, Q	0.37½
Columbus Rexall	Salt Lake	*33	*31	*32½		
Con. Arizona	N. Y. Curb			*3	Dec. '18, Q	0.05
Con. Copper Mines	N. Y. Curb	*57	*46	*55		
Copper Range	Boston	44½	43	44½	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1	*75	*81		
Davis-Daly	Boston	7⅛	7⅛	7⅛	Mar. '20, Q	0.25
East Butte	Boston	11	10½	11	Dec. '19, A	0.50
First National	Boston Curb	†*70	†*60	*60	Feb. '19, SA	0.15
Franklin	Boston	2½	2	2		
Gadsden Copper	Boston Curb	†90	†81	85		
Granby Consol.	New York	30⅜	29½	29½	May '19, Q	1.25
Greene-Cananea	New York	31	31	31	Nov. '20, Q	0.50
Hancock	Boston	2½	2½	2½		
Howe Sound	N. Y. Curb	3	2⅞	3	Jan. '21, Q	0.05
Inspiration Consol.	New York	42	39½	41	Oct. '20, Q	1.00
Iron Cap	Boston Curb	†7½	†6½	8	Sept. '20, K	0.25
Isle Royale	Boston	24	22½	24	Sept. '19, SA	0.50
Kennecott	New York	36⅜	33⅜	35½	Dec. '20, Q	0.50
Keweenaw	Boston	2½	2½	2½		
Lake Copper	Boston	4½	4¼	4¼		
La Salle	Boston	†1⅛	†1⅛	1⅛		
Magma Copper	N. Y. Curb	28⅜	28¼	28¼	Jan. '19, Q	0.50
Majestic	Boston Curb	*10	*10	*10		
Mason Valley	Boston	†3	†1¾	1¾		
Mass. Consolidated	Boston	3¼	3	3	Nov. '17, Q	1.00
Miami Copper	New York	29½	28¼	29¼	May '22 Q	0.50
Michigan	Boston	2⅜	1⅞	1⅞		
Mohawk	Boston	66½	61	65	Feb. '22, Q	1.00
Mother Lode Coa.	N. Y. Curb			9⅛	June '22, I	0.50
Nevada Consol.	New York	17¼	16⅜	17	Sept. '20, Q	0.25
New Cornelia	Boston	19	18	19	May '22, K	0.25
North Butte	Boston	13¼	12⅜	13	Oct. '18, Q	0.25
North Lake	Boston			⅛		
Ohio Copper	N. Y. Curb	*10	*10	*10		
Old Dominion	Boston	25	25	25	Dec. '18, Q	1.00
Osceola	Boston	35	31	35	June '20, Q	0.50
Phelps Dodge	Open Mar.	†180	†170		July. '22, Q	1.00
Quincy	Boston	46½	43	46⅛	Mar. '20, Q	1.00
Ray Consolidated	New York	16½	16	16⅛	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅜	1⅛	1⅛		
St. Mary's Min. Ld.	Boston	48	46	48	Apr. '22, K	2.00
Seneca Copper	Boston			14		
Shannon	Boston	*82	*80	*80	Nov. '17, Q	0.25
Shattuck Arizona	New York	10⅜	10	10⅛	Jan. '20, Q	0.25
South Lake	Boston	*98	*98	*98		
Superior & Boston	Boston	1⅛	1⅛	1⅛		
Tenn. C. & C. cfs	New York	11¼	10⅜	11	May '18, I	1.00
Tuolumne	Boston	*70	*70	*70	May '13,	0.10
United Verde Ex.	Boston Curb	28	27¼	27½	May '22, Q	0.25
Utah Consol.	Boston	3¼	2⅞	3⅛	Sept. '18,	0.25
Utah Copper	New York	65	63	64	June '22, Q	0.50
Utah Metal & T.	Boston	1⅜	1 1/16	1⅛	Dec. '17,	0.30
Victoria	Boston			1⅛		
Winona	Boston	2	1⅜	1⅜		
Wolverine	Boston	12	11⅜	12		
NICKEL-COPPER						
Internat. Nickel	New York	16⅞	16⅛	16⅜	Mar. '19,	0.50
Internat. Nickel, pfd	New York			80¼	May. '22, Q	1.50
LEAD						
National Lead	New York	101	94½	100	June '22, Q	1.50
National Lead, pfd	New York	111½	111½	111½	June '22 Q.	1.75
St. Joseph Lead	New York	14⅜	14½	14⅜	June'22, Q	0.25
QUICKSILVER						
New Idria	Boston	*10	*10	*10		
ZINC						
Am. Z. L. & S.	New York	18	17½	17⅜	May '20,	1.00
Am. Z. L. & S. pfd.	New York			44⅜	Nov. '20, Q	1.50
Butte C. & Z.	New York	7⅛	6⅞	7⅛	June '18,	0.50
Butte & Superior	New York	29⅜	27⅞	28⅛	Sept. '20,	1.25
Callahan Zn-Ld	New York	8⅜	8	⅛	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb			141	May '22, Q	2.00
Yellow Pine	Los Angeles			*55	Sept. '20, Q	0.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1¼	1¼	1¼		
Atlas	Toronto	*24⅜	*23½	*24		
Carson Hill	New York			12		
Cresson Consol. G.	N. Y. Curb	2½	2⅜	2½	Apr. '22, Q, X	$0.10
Dome Mines	New York	30	28½	30	Apr. '22, Q	1.00
Florence Goldfield	N. Y. Curb	*16	*9	*12		
Golden Cycle	Colo. Springs	†*83	†*81½	*81	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb	*6	*5	*6	Dec. '19,	0.05
Gordon Murray	Toronto	*30	*29	*30		
Hollinger Consol.	Toronto	9.38	9.25	9.35	June '22,	0.05
Homestake Mining	New York	71	71	71	June '22, M	0.25
Keora	Toronto	*11¼	*9	*9⅝		
Kirkland Lake	Toronto	*37	*36½	*37		
Lake Shore	Toronto	2.20	2.15	2.18	Nov. '21, K	0.02
McIntyre-Porcupine	Toronto	16.20	16.00	16.10	May '22, K	0.05
Porcupine Crown	Toronto	*20	*17½	*19½	July '17,	0.03
Porcupine V. N. T.	Toronto	20¼	19	19½		
Portland	Colo. Springs	†*20	†*10	*20	Oct. '20, Q	0.01
Schumacher	Toronto	*74	*72	*72½		
Silver Pick	N. Y. Curb	*15	*15	*15		
Teck Hughes	Toronto	*54	*52½	*53½		
Tom Reed	Los Angeles	*55	*55	*55	Dec. '19,	0.02
United Eastern	N. Y. Curb	1 1/16	1 1/16	1 1/16	Apr. '22, Q	0.15
Vindicator Consol.	Colo. Springs	†*6	†*4	*7	Jan. '20, Q	0.01
White Caps Mining	N. Y. Curb	*6	*6	*6		
Wright-Hargreaves	Toronto	2.90	2.50	2.55	July '22,	0.02½
Yukon Gold	N. Y. Curb			*87	June '18,	0.02½
SILVER						
Batopilas Mining	New York	1¼	1⅛	1¼	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*27	*25	*25½	May '20, K	0.03
Coniagas	Toronto	1.25	1.25	1.25	May '21, Q	0.12½
Crown Reserve	Toronto	*15	*12	*14	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	4	3⅜	3¼	Apr. '22, Q	0.12½
La Rose	Toronto	*33	*30	*33	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*28	*24	*28	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1.04	100	1.04	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6	5⅛	5⅛	Apr. '22, Q, X	0.30
Ontario Silver	New York	7⅛	7⅛	7⅛	Jan. '19, Q	0.50
Ophir Silver	N. Y. Curb			*12	Jan. '12,	0.10
Temiskaming	Toronto	*29½	*25	*27½	Jan. '20, K	0.04
Trethewey	Toronto	*4	*3	*4	Jan. '19,	0.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*16	*15	*16		
Cash Boy	N. Y. Curb	*7	*6	*6		
Dolores Esperanza	N. Y. Curb	1⅞	1 11/16	1⅞		
El Salvador	N. Y. Curb	*6	*4	*5		
Jim Butler	N. Y. Curb	*6	*6	*6	Aug. '18, SA	0.07
Jumbo Extension	N. Y. Curb	*4	*4	*4	June '16,	0.05
MacNamara M.&M.	N. Y. Curb	..	..	*6	May '10,	0.02½
Tonopah Belmont	N. Y. Curb			1⅛	July '22, Q	0.05
Tonopah Divide	N. Y. Curb	*81	*78	*81		
Tonopah Extension	N. Y. Curb	1 1/16	1⅛	1⅛	July '22, Q	0.05
Tonopah Mining	N. Y. Curb	1 1/16	1⅛	1 1/16	Apr. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1½	1 1/16	1⅛	June '22, SA	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*6	*6	*6	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	*90	*85	*90	Dec. '20,	0.15
Chief Consol.	Boston Curb	5⅛	4⅞	5⅛	May '22, Q	0.05
Consol. M. & S.	Montreal	22⅛	22	22⅛	Oct. '20, Q	0.62½
Daly Mining	Salt Lake	†2.00	†1.40		July '20, Q	0.10
Daly-West	Boston			1⅞	Dec. '20, Q	0.25
Eagle & Blue Bell	Boston Curb	†3½	†3	2½	Apr. '21, K	0.05
Electric Point	Spokane	7	6	6	May '20, SA	0.03
Federal M. & S.	New York	11⅛	11⅛	11⅛	Jan. '09,	1.50
Federal M. & S. pfd.	New York	51	49	49½	June '22, Q	1.25
Florence Silver	Spokane	*23	*22	*23	Apr. '19,	0.01½
Grand Central	Salt Lake	†65	†60	60	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	6⅞	6⅜	6⅞	June '22, Q	0.15
Iron Blossom Con.	N. Y. Curb	*30	*28	*28	Apr. '22, Q	0.02½
Judge M. & S.	Salt Lake	†2.50	†2.30	2.60	Sept. '20, Q	0.12½
Marsh Mines	N. Y. Curb	*19	*15	*18	June '21, I	0.02
Prince Consol.	Salt Lake	6½	5¾	6½	Nov. '17,	0.02½
Rambler-Cariboo	Spokane	5	5	5	Feb. '19,	0.01
Rex Consol.	N. Y. Curb	*9	*9	*9		
Standard Silver-Ld.	N. Y. Curb			*20	Oct. '17,	0.05
Stewart Mines	N. Y. Curb	*7	*7	*7	Dec. '15,	0.05
Tamarack-Custer	Spokane	3.50	3.17	3.50	Jan. '21, K	0.04
Tintic Standard	Salt Lake	2	2	2	Dec. '21, Q	0.05
Utah Apex	Boston	2⅛	2⅛	2⅛	Nov. '20, K	0.25
Wilbert Mining	N. Y. Curb			*2	Nov. '17,	0.01
VANADIUM						
Vanadium Corp.	New York	46¼	44⅛	45⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	63	61½	62	Apr. '22, Q	1.50
Asbestos Corp. pfd.	Montreal	80	80	80	Apr. '22, Q	1.75
SULPHUR						
Freeport, Texas	New York	25½	23	24	Nov. '19, Q	1.00
Texas Gulf	New York	46¾	45⅛	46½	June '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	62¾	59	60½	Mar. '21, Q	1.00
Amer. Sm.& Ref. pf.	New York	98¾	96⅞	97½	June '22 Q	1.75
Am. Sm. Sec. pf. A.	New York	93	93	93	July '22, Q	1.50
U. S. Sm. R. & M.	New York	41½	40½	41½	Jan. '21, Q	0.50
U.S. Sm.R.& M. pf.	New York	50	50	50	Apr. '22, Q	1.75

NEW MACHINERY AND INVENTIONS

Air-Dump Cars in the Mining Industry

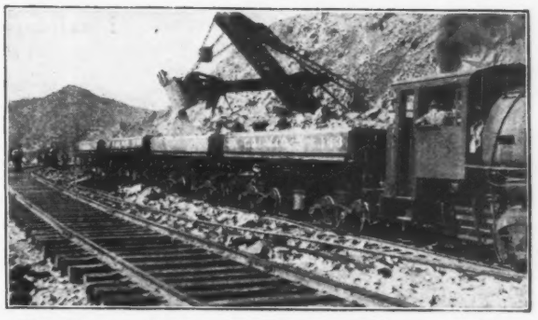
Large Scale Production in Open-Car Operations Requires Corresponding "Quantity-Production" Equipment

By Charles Pierce Burton

THE RECENT MERGER of several large steel companies into one huge concern, second in size only to the United States Steel Corporation, as well as the experience of the latter corporation itself, testifies to the economic necessity of large combinations of capital in the mining of ore and manufacture of steel. Costly installation to give quantity-production is the keynote of success.

The same is true in the copper fields and more or less true in all mining operations. In the copper fields costs are estimated on a quantity-production basis. A copper producer will spend thousands of dollars to save an eighth of a cent for each cubic yard of material moved—a proceeding inconceivable in small business. Perhaps this is one of the greatest lessons to be learned in a survey of modern mining operations.

The economic need for quantity-production in the mining of low-grade ores has been made possible of fulfillment by the development of the steam shovel and its complementary equipment, the modern air-dump car. Perhaps the air-dump car should be mentioned first, for while open-pit mining on a large scale would not be practicable without the steam shovel, the power and efficiency of that machine could not be utilized without the modern dump car. Successful steam-shovel operation is a hauling proposition. It is not the problem of digging which worries the pit superintendent, but the problem of removing the excavated material fast enough to give the steam shovel a chance.



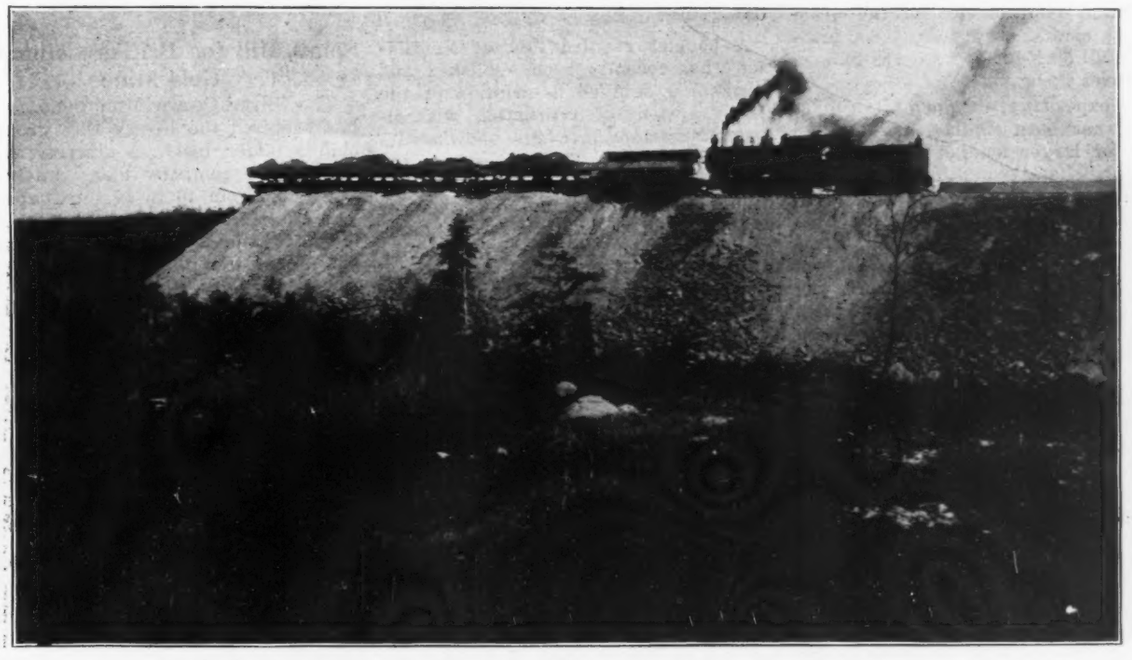
The Copper Queen stripping operation at Bisbee, Ariz., using Western automatic air-dump cars

The air-dump car, as the term is generally understood—a side-dump car with a tilting bed, operated by compressed air—was originated by the Western Wheeled Scraper Co. of Aurora, Ill. Although the increasing demands of open-pit mining are responsible in a large measure for the development of this car to its present size and perfection, it was designed primarily for use in constructing the Panama Canal.

The United States Steel Corporation and other large operators on the Lake Superior iron ranges were not slow to apply this new device to their own problems. The Steel Corporation had been using smaller dump cars operated by hand for several years in its stripping operations. The first stripping on the Mesabi Range was done with teams and scrapers, or with wagons loaded by hand. The 1-yd. car was first hauled by team, but this was found inadequate to meet the increasing demands for stripping, and small locomotives were substituted for teams. Then came 3-yd. cars, 8- and 9-ton locomotives and shovels with 1½-yd. dippers. Still the demand for larger loading units continued, and 4-yd. cars were installed, with 10- and 15-ton locomotives and Model 60 shovels. Finally the Steel Corporation adopted a 7-yd. car which was believed to be the last word in dump-car design and construction.

Standard gage equipment and 2-yd. dippers followed, with 73-ton locomotives and 7- to 74-ton shovels; then still heavier shovels with 2½-yd. dippers, although used with 7-yd. cars. The first 12-yd. dump cars on the Mesabi were installed by the Mahoning Ore & Steel Co. They were the immediate forerunners of the air-dump type. This increase in the size of dump cars required greater power, and 105-ton locomotives and 107-ton shovels gradually came into use.

Still the demand was for larger cars. Sixteen-yard cars were installed, the larger size having been made possible by the air-dumping device; then 20-yd



Typical dumping scene on the Mesabi Range

This is one of the dumps at Virginia, Minn., operated by the Oliver Iron Mining Co. The train of five 20-yd. Western air-dump cars was dumped and righted in fifteen seconds. Round trip from the shovel seven and one-half miles; trains averaging six round trips per ten-hour day, five cars to the train. Maximum grade, 2½ per cent. Each locomotive handles thirty cars per day.

cars, used with 136-ton locomotives, 138-ton shovels and 5-yd. dippers. The present 360-ton revolving shovels with 8-yd. dippers and 30-yd. air-dump cars represent the high-water mark of development in this direction.

In 1916 the United States Steel Corporation, through its subsidiary, the Oliver Iron Mining Co., undertook an important experiment with air-dump cars, to develop a type adapted to the exceedingly heavy work on the Mesabi Range. Five makes of cars were selected for the tests; ten 20-yd. cars of each make were put into active stripping service.

"We drop a weight of 15 tons from a distance of 7 to 8 ft. into a car," said one of the engineers, "and then wonder why the car breaks. As a matter of fact, no man can design a car which will stand the strain. We have to keep on breaking them and thus find out their weak points."

As a result of the test, specially designed 20-yd. air-dump cars of the automatic compression-lock type were installed on the Mesabi in large numbers. Still the demand for quantity-production was not satisfied, and since then many similar 30-yd. cars have been installed. Earth-moving on the Mesabi is easily the largest steam-shovel operation in the world, involving in normal times the moving of from 25,000,000 to 30,000,000 cu. yd. of material each year.

"What is your main problem in stripping?" was asked of one of the mine superintendents at Virginia, Minn. His reply is worth framing, for it is the production problem everywhere: "To keep a string of empties coming up to the shovel."

Another operator defined the problem in a similar way: "The basic principle in all open-pit operation is to keep the shovel going."

The experience in open-pit copper mining has been similar, and the demand for larger loading units equally insistent. Local conditions sometimes limit the size of car that can be used, as in the case at Jerome, Ariz. When the United Verde Copper Co. commenced operations on a steam-shovel basis in 1919, E. E. Vanderhoef, the superintendent, experimented with various air-dump cars. The layout and switches there are such that 30-yd. cars, like those on the Mesabi, were too long to be operated successfully, although cars of large capacity were desired. The superintendent's problem was to secure a dump car of maximum carrying capacity, in space of the shortest possible length, and at the same time come within the limits of safety in the matter of height above the rail.

He solved the problem by adopting a special size of car which embodied the automatic compression lock, a car of the same length as a standard 20-yd. car but of 25-yd. capacity. Steam-shovel operation at Jerome was discontinued Nov. 20, 1920, but the 25-yd. cars again were put to work Feb. 20, 1922.

Flexipipe—A New and Improved Ventilation Tubing

The system of ventilation of inclosed working places, such as shafts, winzes, raises, tunnels, adits, and stopes, by the use of the flexible tubing and blower units has come to be generally recognized as a decided step forward in underground work.

A number of years ago, realizing the great loss in time between shifts in the driving of tunnels, sinking of shafts and other underground work, due to the inability of men to return promptly to the working faces because of the powder fumes, mining engineers sought a means for successfully and quickly ventilating these working places. The idea of a light canvas tubing was suggested and the first to be manufactured and placed on the market was manufactured by the Bemis Bros. Bag Co., St. Louis, Mo., and known by the trade name of "Flexoid" tubing.

In the early use of "Flexoid" tubing in metal mining operations it was found that acid mine-water, dry rot, dampness, gases and other underground conditions caused a deterioration of the tubing, and it was evident that a successful material for ventilation purposes in metal mines must be so fabricated and treated as to overcome these difficulties. After four years of research and experimental work a tubing was evolved by the Bemis Bros. Bag Co. and it is claimed that this meets every underground condition and will withstand the hardest kind of usage and the attack of the destructive elements found in underground mine operations. The new tubing has been named "Flexipipe" and is manufactured by a secret process.

A booklet entitled "Better Ventilation" has recently been published and contains a detailed description of the Bemis system of ventilation with illustrations and drawings showing its use underground. The structure of the tubing, method of handling underground, connecting it up, and other descriptive matter is included. A number of concrete examples are cited as to the savings made possible by the use of the Bemis system. This interesting booklet will be sent upon request to those interested by addressing Bemis Bros. Bag Co., St. Louis, Mo.

Leslie H. Webb, vice-president of the Wedge Mechanical Furnace Co. of Philadelphia, has recently been transferred to the management of the Pittsburgh offices of the Pennsylvania Salt Manufacturing Co., the parent company of the Wedge Mechanical Furnace Co.

The Susquehanna Collieries Co. at Lykens, Pa., has just placed an order for two additional 42-in. Fuller-Lehigh gear-driven, screen-type mills, which will make a total of six in the plant, pulverizing anthracite culm. The Sandusky Cement Co., Cleveland, is also installing three similar mills.

CONSTRUCTION NEWS

Mill Near Tonopah Will Be Remodeled

It is reported that Charles A. Stoneham will remodel the present 150-ton flotation plant at the Kanrohat property about 65 miles north of Tonopah, Nev., changing it into a cyanide plant. Flotation did not prove successful in treating the class of ore mined.

Reduction Plant for Eureka, Nevada

Following the purchase of the Eureka & Palisade Railroad by interests connected with one or more of the mining properties at Eureka, Nev., it is reported that a plant for treating low-grade ores will be erected.

Crushing Plant Will Be Erected by Princeton (B. C.) Mining Development Co.

An additional railway spur will be put in at the property of Princeton Mining & Development Co., near Princeton, B. C., and eight miles from the concentrator of the Canada Copper Corporation, to furnish necessary facilities for shipping mill ore to the Canada Copper's plant when operation is resumed there. In the meantime some shipments of higher grade material will be made to the Consolidated Smelter at Tadanac. A recent shipment showed 16.8 per cent copper, four oz. silver, and $2.45 gold per ton. The company intends to install a 50-ton crushing plant.

Small Mill for British Columbian Gold Mine

The Silver Crown Mining Co., which has acquired the Foggy Day group of claims under bond, is starting active work. The company plans putting in a mill of from 40 to 60 tons capacity. The ore is free milling, and a test shipment to the Trail smelter averaged $82.76 per ton gold. The property is near the Silver Cup mine and access is by way of Trout Lake.

Old Dominion Will Remodel and Enlarge Concentrator

The Old Dominion Copper Co. will increase the capacity of its milling and concentrating plant at Globe, Ariz., from 700 to 1,000 tons per day. New machinery will be installed and some changes will be made in the flow sheet.

New Wasatch Mill in Colorado Starts Shipments

The Wasatch mill, in Clear Creek County, Col., has been overhauled and is shipping zinc and lead concentrates at the rate of about 300 tons per month. The zinc goes to the United States plant at Blende, near Pueblo, and the lead to the smelter at Leadville.